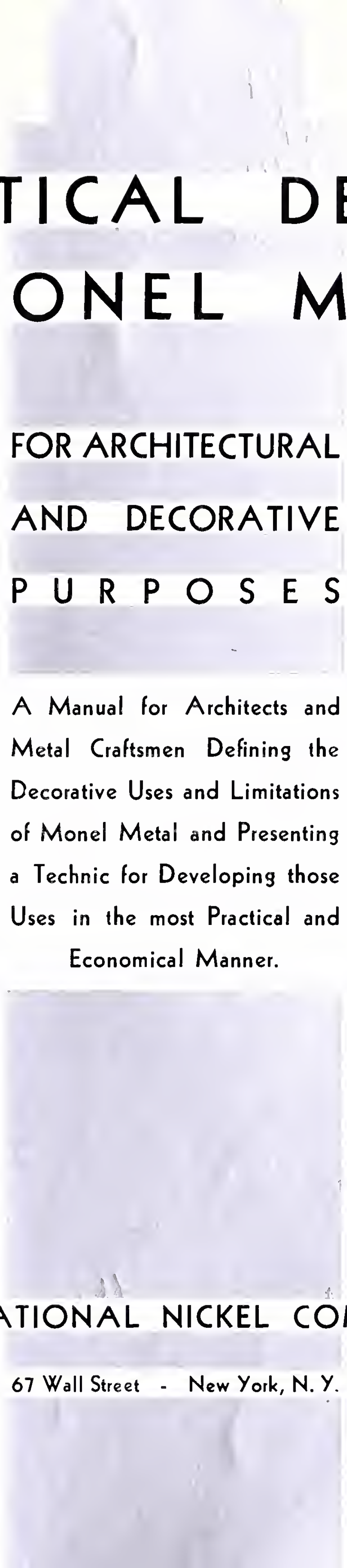
A. I. A. File No. 15-G

PRACTICAL DESIGN IN MONEL METAL

PRACTICAL DESIGN IN MONEL METAL

Digitized by the Internet Archive
in 2017 with funding from
Columbia University Libraries

https://archive.org/details/practicaldesigni00inte



PRACTICAL DESIGN IN MONEL METAL

FOR ARCHITECTURAL AND DECORATIVE PURPOSES

A Manual for Architects and Metal Craftsmen Defining the Decorative Uses and Limitations of Monel Metal and Presenting a Technic for Developing those Uses in the most Practical and Economical Manner.

THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street - New York, N. Y.

Copyright, July 1931
The International Nickel Company, Inc

Planned and Edited for Architects
by TAYLOR, ROGERS & BLISS, Inc.

CONTENTS

Metals and Metal Craftsmanship 7

Properties of Monel Metal 9
  What is Monel Metal?
  Appearance, Color, Finishes
  Physical, Mechanical, Chemical Properties

The Personality of Monel Metal 13
  The Color and "Feel" of Monel Metal
  The Textures of Monel Metal
  The Use of Colors
  Weathering of Monel Metal
  Forms in Which Monel Metal May be Used
  Period and Modern Designs in Monel Metal

Practical Craftsmanship in Monel Metal 19
  Forms in which Monel Metal is Available
  Methods of Working and Assembly
  Economy in Production Depends upon Design

Practical Design in Monel Metal 25
  Eliminating Extruded Shapes
  Design of Forged Details
  Designing Cast Monel Metal Details
  Etched Work and Engraving
  Designing Drawn Shapes
  Built-up Sections of Flats, Rods, Angles and Tubes
  Repoussé, Enameling and Other Processes
  Use with Other Metals

Applications of Monel Metal 37
  Doors of Monel Metal 38
  Elevator Doors 40
  Revolving Doors 41
  Monel Metal Has Many Uses in Banking Quarters of All Types . . 42
  Grilles, Railings and Gates of Monel Metal 44
  Architectural Details and Accessories for Lobbies and other Public Spaces 46
  Hardware and Lighting Fixtures Effectively Developed in Monel Metal 48

Notable Decorative Details Expressed in Monel Metal 51

Utilitarian Uses of Monel Metal in Building Construction and Equipment 63
  Roofing, Expansion Joints
  Food Service Equipment
  Domestic Applications
  Inco Standardized Kitchen Sinks

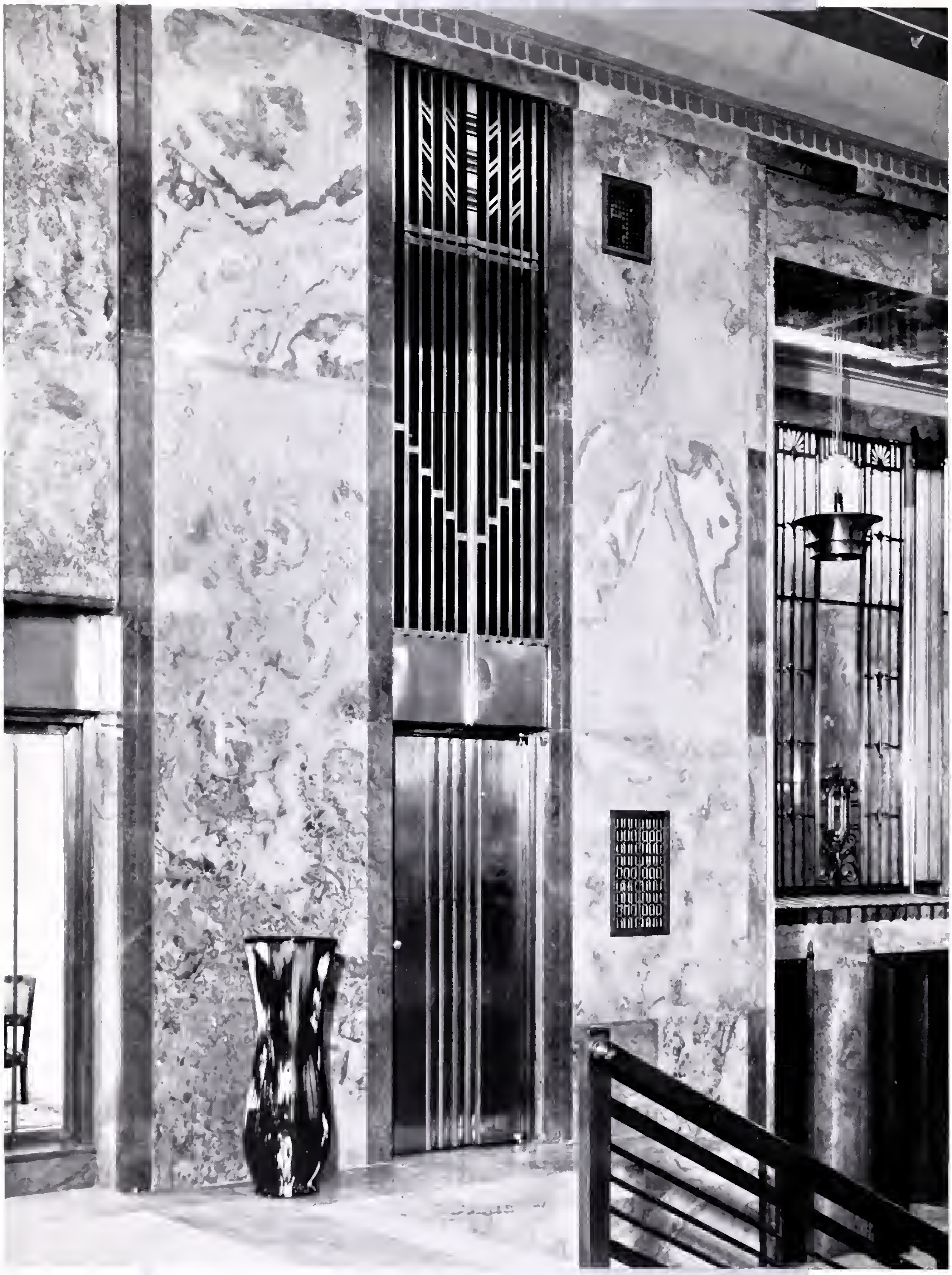


Fig. 1

"The sympathetic use of metals in decorative design must be founded upon a knowledge of their characteristics, their behavior in the hands of the fabricator, and their individual 'personalities'."

Monel Metal door and grille in the T. Eaton Store, Toronto, Canada. Ross & MacDonald, Architects, Montreal, Canada. Sproatt & Rolph, Associate Architects, Toronto, Canada. Executed by Architectural Bronze & Iron Works, Toronto, Canada.

Metals and Metal Craftsmanship

MANY centuries before the so-called white metals first gained recognition as media suitable for the expression of architectural details, master designers appreciated their decorative value and used them in ways similar in principle to the manner in which they are employed today. Chinese craftsmen, in developing pottery of extraordinary quality and design, employed a white metal "Packfong" to give emphasis to foci of their designs and to help blend, by its white hue, the various colors employed in their compositions. Packfong was a nickel-copper-zinc alloy more like Monel Metal in color and in nickel content than the nickel silvers of the present day. It was perhaps the first white alloy employed in decorative art.

The use of semi-precious silver, primarily in ecclesiastical architecture, followed later by more mundane pewter for decorative and utilitarian domestic appurtenances, showed the sustained interest of designers in the white metals when their choice was exceedingly limited by costs or by knowledge of the art of creating white alloys, or both.

Today the use of white metals has been vastly stimulated by two factors. First, the availability of many relatively new metals through greater knowledge of metallurgy, and second, through the modernist trend in design which has found in white metals a medium of expression of extraordinary beauty and usefulness. Among the white metals available for architectural and decorative purposes are nickel and Monel Metal, aluminum and several compositions of nickel chromium steel, broadly referred to as stainless steel. These metals stand in the first rank as decorative white metals. Others are Benedict metal, German silver, zinc and alloys of nickel, aluminum, chromium, zinc and copper.

The "Personality" of Metals

None of the so-called white metals is really white, but each has a characteristic hue that clearly distinguishes its color but which varies with the composition of the metal and the finish employed. Some hues may be classed as distinctly gray; others greenish white, blue white or yellow white.

Similarly none of these white metals are identical in their texture, hardness, tensile strength, reflectivity, ability to take polish or in other physical properties which are felt or seen and which thus contribute to the decorative significance of the metal. Some of the white metals are so soft that they can readily be scratched with a pin or even with a thumb nail; others are exceedingly hard. Some can be rolled and welded; others are used mostly for castings; still others may be extruded.

Nor is the behavior of these white metals identical. After they have been developed in decorative forms and have been put into service, some change their color characteristics upon exposure; some are easily cleaned and others are not; some tarnish or corrode more readily than others; some acquire a patina that is more pleasing than the raw metal.

All of these variations in behavior, in physical properties and in appearance aid in distinguishing one metal from another and may be said to contribute to the "personality" which each metal possesses. One distinguishes a human by his features, his behavior, his physical strength and his coloring as much as by his mental and moral qualities. The combination of these characteristics constitutes human personality. This matter of the personality of metals is of sufficient importance to be developed more extensively in another chapter; but for the present, it is merely our purpose to note that each white metal has individuality, distinctiveness, personality or whatever else one wishes to call it that must be recognized by the designer who is choosing between these metals to create any desired effect or to serve under any given set of conditions.

Limitations and Uses

A connoisseur of metals will recognize that each metal has its own proper applications and its own limitations. Architects who have studied the decorative white metals choose between them with the discrimination of an epicure selecting the proper delicacies to balance the composition of his repast. Some white metals, to be sure, have greater adaptability to meet varying conditions of use than others and thus command wider recognition, but it is a very practical matter in the design of decorative metalwork to understand and appreciate fully the limitations of each metal so that one may not inappropriately be employed for a purpose to which another is better adapted. A sense of "fitness" should prevail.

Technic of Design and Fabrication

To a very considerable extent, the limitations upon the use of individual metals are those imposed by methods of fabrication, and these limitations in turn must be recognized in design. It is a common mistake among architects not familiar with fabrication methods to design shapes that must be extruded and to call upon their craftsmen to create their designs in a metal that cannot be extruded. Similarly the inexperienced designer may indicate welded construction, or brazing or soldering, for metals that cannot be satisfactorily welded, or brazed or soldered. The result is usually unhappy, for it produces an effect very different from that which the designer has conceived, or it adds unduly to the cost of production.

Essentials To Successful Design

The important point then to keep in mind when working with metals for architectural decorations and accessories is that each metal has its limitations and its proper uses, each has its own technic of design and fabrication and that each should be employed sympathetically by the designer with a full knowledge of its properties and characteristics. Only under such circumstances can the designer's conception properly be secured by the craftsmen and only when the metal is thus chosen with full regard to its "personality" can its merits be fully developed.

Presenting Monel Metal

The purpose of this book is to place before architects such knowledge of Monel Metal as will enable them to employ it in the most advantageous manner. In the following pages will be found essential data concerning the physical properties of Monel Metal, a discussion of its personality as a factor in design, a presentation of the technics of both fabrication and design in Monel Metal, and a presentation of its more important applications to architectural problems.

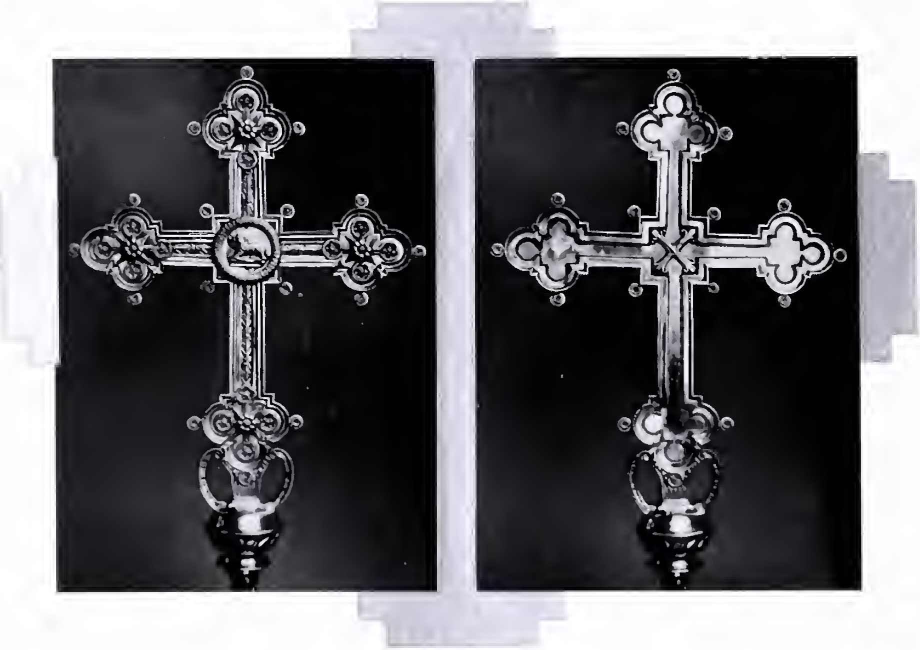


Fig. 2
Processional cross in Monel Metal, designed by W. D. Crane, and executed by W. E. Whiteside & Company, Ltd., South Harrow, England

Properties of MONEL METAL

SINCE the designer for ornamental or decorative metal work frequently uses metals for structural or semi-utilitarian purposes, it is not merely sufficient to know the appearance of the metal, but also its strength and physical properties. Similarly, the rigidity, toughness, ductility and general workability of the metal must necessarily influence his design. These characteristics also should be understood. In this brief chapter are presented data, in non-technical form, of those properties of Monel Metal which have a bearing upon its use for ornamental and decorative structural purposes.

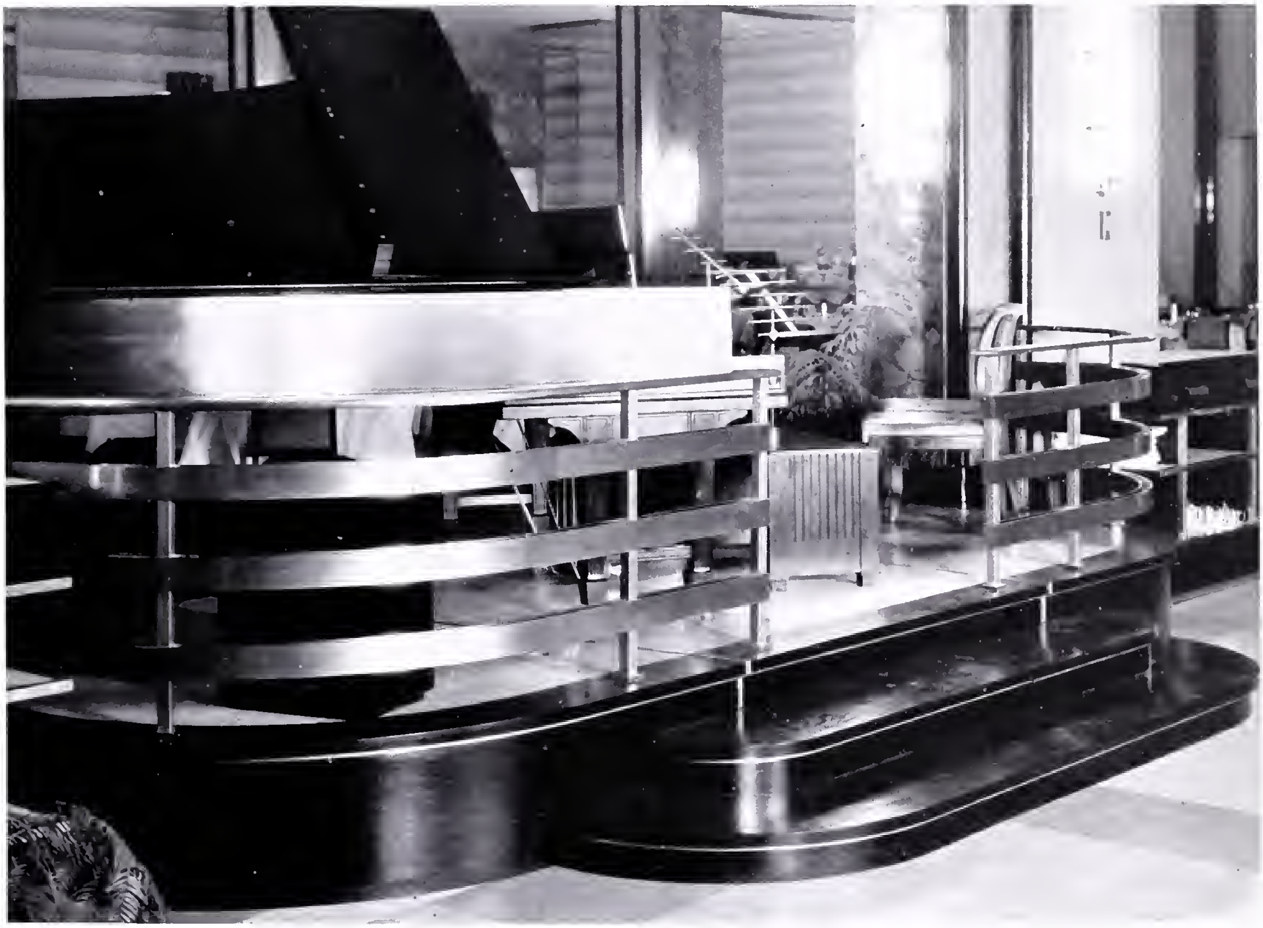


Fig. 3
Architectural integrity is preserved by the use of Monel Metal where structural strength must be combined with decorative qualities. No hidden reinforcement is employed in such units as this railing in the dining room of the T. Eaton Store, Montreal, designed by Jacques Carlu for Ross & MacDonald, Architects. Executed by Robert Mitchell Co., Ltd., Montreal.

What Is Monel Metal?

"Monel Metal" is a registered trade mark applied to a technically controlled nickel-copper alloy of high nickel content. Monel Metal is mined, smelted, refined, rolled and marketed solely by The International Nickel Company, Inc. Its composition is approximately two-thirds nickel and one-third copper.

Monel Metal can be formed, machined, cast, forged, spun, drawn, brazed, soldered, welded, and cloissoné and champlevé enameled. In short, it can be worked in any way employed with other metals, except that it cannot be extruded.

	Density	Melting Point Degrees C	Specific Heat	Heat Expansion Per °C	Heat Cond'y % of Cu	Elect. Cond'y % of Cu	Coef. of Elect. Res. Per °C	Modulus of Elast'y psi
Monel Metal	8.80	1315	0.127	.000014	6.6	4.	.0019	26,000,000
Nickel	8.85	1440	0.130	.000013	15.5	16.	.0041	30,000,000
Copper	8.89	1083	0.093	.000017	100.	100.	.0040	16,000,000
Brass	8.46	900	0.088	.000020	28.	28.	.0015	13,800,000
Phosphor Bronze	8.66		0.104	.000018		36.	.0039	16,000,000
Everdur	8.30	1050		.000017	30.	6.		15,000,000
Nickel Silver	8.75		0.095	.000018	7.6	5.2	.0003	17,000,000
Iron	7.7	1535	0.110	.000013	15.	15.	.0062	25,000,000
Steel	7.9	1400		.000013	6-12	3-15		30,000,000
Cast Iron	7.2	1000-1200		.000010	10-12	2-12		12-27,000,000
Duriron	7.0	1260		.000028	17.4	2.5		
14% Cr Iron	7.7	1490		.000011	5.	2.8		30,000,000
17% Cr Iron	7.6	1400		.000010	5.		.0015	
18/8 Cr/Ni Iron	7.9	1400	0.118	.000017	3.6	2.8		28,600,000
Zinc	7.14	420	0.094	.000029	29.	28.2	.0040	13,700,000
Lead	11.38	327	0.031	.000029	9.	7.8	.0041	800,000
Aluminum	2.7	660	0.218	.000024	52.	56-59	.0042	10,000,000
Duralumin	2.8	600		.000022	40.	32.		10,000,000
Silver	10.51	960	0.056	.000019	110.	106.	.0040	9,000,000
Platinum	21.5	1755	0.032	.000008	18.	15.	.0036	23,000,000

Fig. 4
The physical properties of Monel Metal compared to other structural and decorative metals.

Appearance, Color and Finishes

Monel Metal is classed as a distinctly white metal more closely akin to platinum in color and reflectivity than to any other well known metal. Since the color of a metal is derived from its capacity to reflect or absorb light rays of different wave lengths it is worthy of note that Monel Metal reflects all light waves within the range of sensitivity of the human eye more uniformly than platinum, thus giving it a whiter appearance. Both Monel Metal and platinum reflect slightly more light waves at the red end of the spectrum than at the blue, producing a warmer white than if the opposite tendency were present.

Monel Metal may be finished in a variety of ways, ranging from the sand-grained surface of unfinished castings to a mirror polish, with intermediate finishes in great variety. The standard mill finishes are described on page 19 in conjunction with the commercial forms in which Monel Metal is available.

Physical Properties

The accompanying table, showing the comparative physical properties of twenty metals is of interest in showing how Monel Metal compares with other familiar materials in such matters as density, melting point and modulus of elasticity. Density, which expresses the relative weight of equal volumes of metals, is readily appreciated by noting that Monel Metal has a density of 8.8, practically the same as bronze, in comparison with aluminum of 2.7 as one extreme and lead of 11.38 as another. The melting point is of interest as it has a bearing on the ease or difficulty with which castings can be made. Monel Metal in this regard has a slightly lower melting point than steel, but has too great strength at high temperatures to permit commercial extrusion such as is practical for aluminum and high zinc bronzes.

The modulus of elasticity is an expression of the relative rigidity of the metal—that is, its ability to resist deformation until the elastic limit of the metal has been reached. It will be noted that Monel Metal is again comparable to steel in this respect and is considerably more rigid than the softer decorative white and colored metals.

Mechanical Properties

The mechanical properties of Monel Metal, insofar as they have a bearing upon ornamental and structural uses in buildings, cannot readily be expressed on a comparative basis without entering into highly technical discussions. Monel Metal has the strength of steel, permitting its use without hidden structural supports in exactly the same way as wrought iron or steel might be employed. It is ductile, permitting drawing, rolling, bending, stamping and spinning, but the toughness of the metal requires the application of greater force in these operations than is normally required.

The toughness of Monel Metal is a marked characteristic, adding slightly to the difficulties of machining the metal as compared to mild steels. Nevertheless, by slight changes in the design of tools, Monel Metal may be readily turned, milled or otherwise machined to any form desired.

The hardness of Monel Metal depends upon whether or not it is annealed, hot worked or cold worked. All types are used for decorative purposes.

Chemical Properties

Since the chemical properties of metals used for decorative purposes are primarily of importance as indicating their resistance to atmospheric and general corrosion, it is well to note that Monel Metal is widely employed in the chemical and allied industries because of its marked resistance to corrosion coupled with its high tensile strength. Alkalies, hot gases, saline solutions and all but a few acids are withstood by Monel Metal.

Galvanic corrosion or electrolysis, though often occurring where two dissimilar metals in contact are submerged in aqueous solutions, particularly in acids, will not be experienced in atmospheric exposure except under special conditions. Monel Metal may be used in contact with brasses, bronzes, copper, the chromium alloys in indoor and outdoor atmospheric exposure without fear of galvanic action. Likewise Monel Metal may be used in contact with aluminum and its alloys, zinc, and coated iron, in indoor atmospheres and in most outdoor atmospheric conditions, without galvanic action.

Where outdoor conditions are severe, leading to a continually moist condition at the contact of the dissimilar metals, there will be a tendency towards mildly accelerated action of aluminum and its alloys, zinc, and imperfectly coated iron when in contact with Monel Metal or the high copper metals. Such mildly accelerated action, however, would become appreciable only after indefinitely long periods of exposure, and for most purposes would be immaterial. To be on the safe side, and not because of any certainty that serious action would occur, it is usually wise to avoid the use of aluminum and its alloys or imperfectly coated iron and steel for parts that are to take relatively heavy stresses—bolts, screws, etc.—when these parts are coupled with Monel Metal or high copper metals in moist outdoor exposure.

Characteristics of Monel Metal in Design

In the following chapter will be found a wholly non-technical discussion of the physical, mechanical and other properties of Monel Metal as they influence its use in architectural problems of all types. These properties contribute to what we may term the personality of Monel Metal.

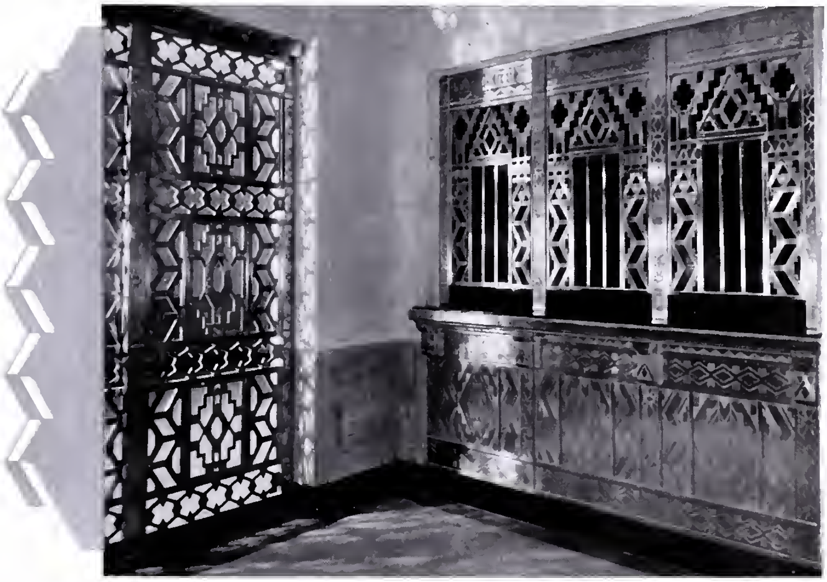


Fig. 5

The steel-like strength, toughness and everlasting durability of Monel Metal gives significance to its use in banking quarters. Lobby of entrance to safe deposit vaults, Union Trust Company, Detroit, Michigan. Designed by Smith, Hinchman & Grylls, Architects, Detroit, Michigan. Executed by The Gorham Co., Providence, Rhode Island.

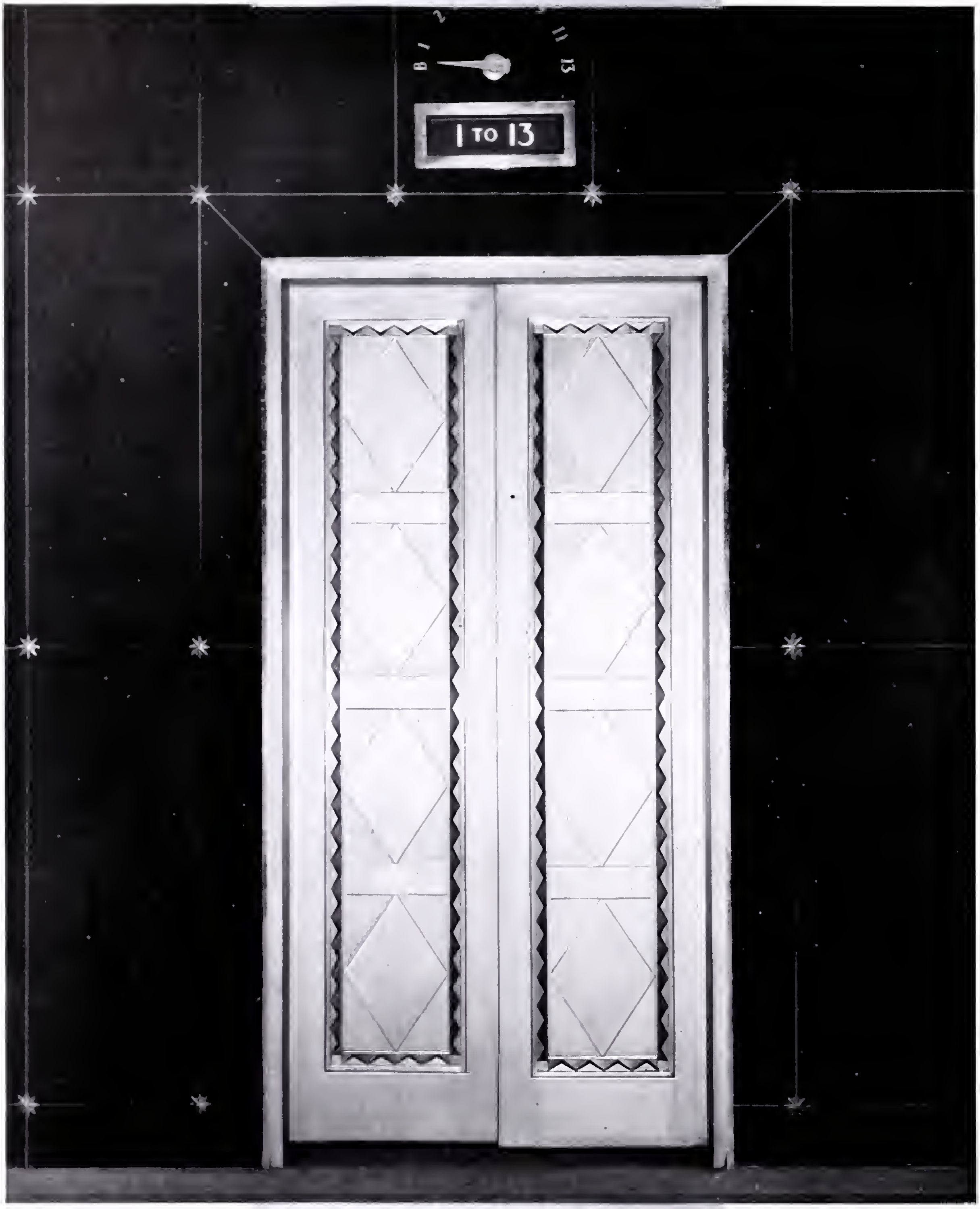


Fig. 6
Brilliantly expressive of the personality of Monel Metal, these elevator doors for the Wall and Hanover Building, New York, designed by Delano & Aldrich, Architects, New York, also reflect a thorough knowledge of the fabricator's art. Executed by The Superb Bronze & Iron Co., Inc., N. Y.

The Personality of MONEL METAL

GOLD suggests luxury, warmth, ruddiness, richness and masculinity. Silver seems to carry the suggestion of femininity, coolness, brilliance. Platinum appears to many as being aristocratic, keen, brilliant but cold. Steel denotes strength and hardness, while wrought iron has a distinctly friendly and graceful connotation. Bronze gives an impression of warmth; it suggests antiquity, and one always associates with it the thoughts of permanency, durability and sturdiness.

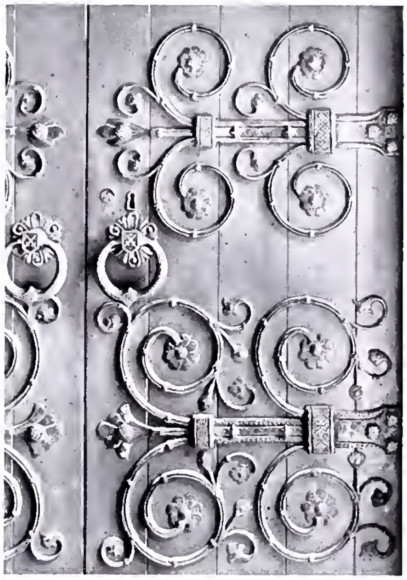


Fig. 7

Detail of hardware on main entrance doors, St. Paul's Church, Chestnut Hill, Pa. Executed in Monel Metal by Jacob Schmidt, Philadelphia, Pa. Zantzinger, Borie & Medary, Architects.

Thus each of the better-known metals may be said to have a personality of its own attributed to inanimate elements and characteristics not very different from those which are employed to distinguish the personality of various human beings.

It is equally true that each of the white metals has a personality of its own, but it is harder to describe the distinguishing characteristics of white metals because they have not yet acquired the associations that accompany the more familiar metals. Nevertheless, if one could place before him samples of each of the white metals in corresponding textures and forms, there would instantly be apparent very clear distinctions between Monel Metal, aluminum, the stainless steels, nickel, Benedict metal and all of the others in the category. One would instantly sense the relative softness of some of these metals and the hardness of others. The difference in whiteness would be apparent, for some appear white gray, others with a reddish cast, and the rest show hues of green, blue and yellow.

To make such a study of the white metals is as revealing as to study the individuals in a strange tribe of aborigines. As the explorer first looks upon these strangers, he recognizes a tribal or racial similarity just as the white metals are grouped together because of the dominant color tone. But on closer examination, he begins to perceive those distinguishing marks that later will enable him to know the individuals apart from each other and to classify them as accurately as he classifies his familiar friends and neighbors at home.

Architects seriously engaged in developing metalwork, with an earnest desire to express their designs with that completeness and simplicity which distinguishes the work of a creative artist from the mediocre efforts of an apprentice, should first attain that intimate knowledge of the various metallic media available to him which he already possesses with respect to stone and wood and bronze and other more familiar pigments on his decorative palette.

The Color of Monel Metal

Even though Monel Metal is made up of approximately one-third copper, it is not sufficient to give a yellowish tone. Monel Metal, rather, has a slightly bluer cast than pure nickel. In this respect it is strikingly different from the nickel copper alloys of higher copper content, where the bluish cast is gradually replaced by a distinct yellowish tinge, typified by the color of nickel silver.

The "Feel" of Monel Metal

Since Monel Metal is as hard as steel, it has a feel that distinguishes it from the softer alloys and white metals. This hardness and strength contributes in two ways to the distinctive personality of the metal. In the first place it enables the designer to employ Monel Metal in structural forms without secondary support—hidden or exposed—that is so frequently necessary with less rigid materials. It can thus be employed to express its strength with that integrity which characterizes all good design; it can combine structural and decorative functions without violating the precept of honest architecture.

The second attribute of this hardness and strength is apparent in the finishes which can be employed on Monel Metal. They range from the untouched sand finish of gray iron castings, through the hammered surface common to wrought iron, to the finest polished finishes that can be obtained on any of the decorative metals. Monel Metal is amenable to the most delicate wrought traceries or to the vigorous strength of heavy turned sections, cast units or platework. In any of these forms, this metal has that feeling which reveals strength, durability and hardness without the hidden weaknesses of a brittle or inflexible material.

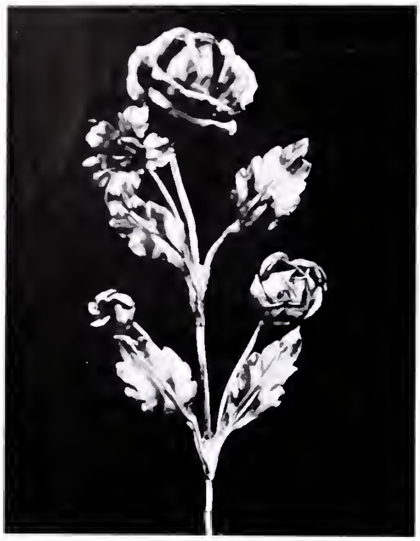


Fig. 8
Rose executed from Monel Metal sheets and rods by forging, repousse and welding.

The Textures of Monel Metal

Just as the mood of a man normally modifies his personality without changing its basic structure, so the various surface treatments which may be employed with Monel Metal influence the expression of its design personality without changing its inherent qualities. The range of textures has already been indicated, but some of the more important finishes require special mention.

Monel Metal castings are made in the same manner as gray iron or steel castings. When left as the metal comes from the mould, it has a distinctly light gray color, considerably lighter than gray iron and with the usual sand-finish texture. Upon the method of finishing castwork depends its final texture. The metal may be machined, hand tooled, ground, hammered or polished.

Forged work leaves Monel Metal with the same tool marks as are obtained on wrought iron, but in the heating preliminary to forging a black oxide appears on the surface. This oxide tends to adhere tightly to the metal and is not removed in the hammering process excepting where the metal is heated under strongly oxidizing conditions. In this case, it is partially but not wholly removed by the hammering process. If desired, this black oxide may be left in the hollow parts not touched by the anvil or hammer so that the black oxide contrasts with the bright work of the hammered parts, giving the exact appearance of wrought iron that has been high-lighted by filing or grinding the surface without entirely removing the hammered finish. With Monel Metal work the bright parts tend to remain bright, whereas with wrought iron the bright finish must be preserved by oiling, lacquering, or other protective finish.

Machine surfaces take the characteristic finish of the metal itself, the texture depending entirely upon the type of tools employed.

Rods, tubes and sheets of Monel Metal can be given a variety of finishes, ranging from a wire-brush finish to a No. 5 polish which is mirror-like in its brilliance and reflection. With the No. 5 finish, Monel Metal reflects colors and forms so accurately that it takes on much of the color of the objects surrounding it or reflected from its surface. The intermediate degrees of polish, from a No. 5 to a wire-brush finish, bring out in varying degrees the whiteness and self-color of the metal.

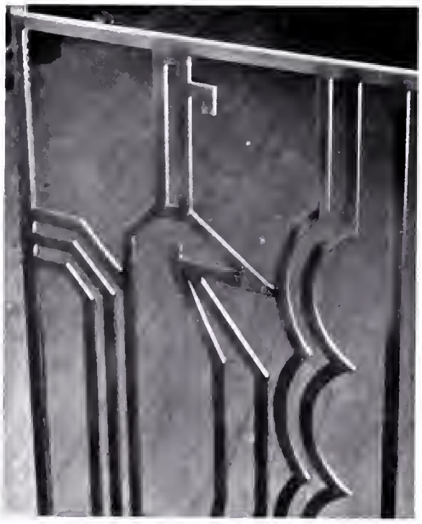


Fig. 9
Detail of fire screen of Monel Metal designed by Winold Reiss and executed from solid plate and rods by E. Techner.

In spite of the fact that Monel Metal is extremely corrosion resistant and is used for handling many corrosive chemicals, an etching fluid has been developed which permits Monel Metal to be etched as readily as steel, glass and other hard materials. The etching comes through clean and brilliant with the texture resembling that of a sand blasted finish on glass. This etched texture is very pleasing in contrast to polished plane surfaces. Rolled and drawn Monel Metal shapes can be finished in the same manner as sheets and rods.

The Use of Colors with Monel Metal

There are certain surface treatments that give opportunity for using color in combination with the metal itself. The first of these is enameling which is frequently used in conjunction with etching to give a brilliant color to the recessed parts. Black enamel, contrasting with the brilliant white of polished Monel Metal, is a particularly satisfactory combination.

Another method of coloring is cloissonné, employing the same process used with other metal backing.

Black oxide of Monel Metal can be created by heating, giving the metal a highly durable black surface that can only be removed by grinding. The effect of this treatment is similar to that of a black enamel, except that the oxide has a dull or egg-shell finish as compared to the glossy surface of enamel work.

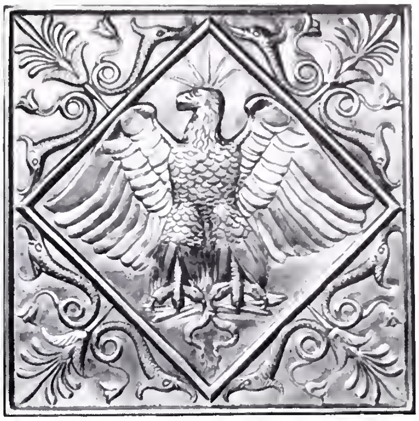


Fig. 10
Crisp details are readily achieved in Monel Metal castings. Plaque by Superb Bronze & Iron Company, Inc., Brooklyn, N. Y.

Weathering of Monel Metal

While on the subject of color and color effects in Monel Metal, it is well to discuss here the behavior of Monel Metal when exposed to atmospheric conditions of various types. There is a great deal of misunderstanding as to the behavior of white metals in normal atmospheric exposures. All metals acquire a surface film of dirt, whether exposed indoors or out. This film gradually diminishes the brightness of the metal itself, but is usually of a type that can be readily removed, restoring the original lustre, without heavy polishing or cleaning.

Tarnish and corrosion are quite different and are the results of chemical action—generally oxidization of the metal. If Monel Metal is used out-of-doors in inaccessible positions where it cannot be cleaned at periodic intervals, it will gradually acquire a grayish-green patina, eventually darkening to a mottled green, brown and black. Such is the color of the Monel Metal roof on the Pennsylvania Railroad Station in New York after more than twenty years of exposure without cleaning or care of any kind. When the location of the metal is such that it is subjected to the drying effect of bright sunlight and the cleansing effect of the free sweep of rain, it does not develop the patina described above but acquires a thin, translucent film not greatly different in shade from the original color of the metal. Development of a patina is not to be considered as corrosion of the ordinary sort, because there is no appreciable loss in weight or strength such as takes place when the ferrous metals rust.

Monel Metal exposed out-of-doors, but cleaned of the normal surface film at regular intervals, remains light in color and may easily be kept in its original bright condition. The amount of cleaning required to keep Monel Metal bright, even on outdoor exposures, is less than that of most other white metals and less than is usually accorded to bronze or polished marbles.

When exposed indoors to ordinary atmospheres, Monel Metal remains bright if cleaned at suitable intervals, but in this case the intervals are still less frequent than are required for outdoor exposures.

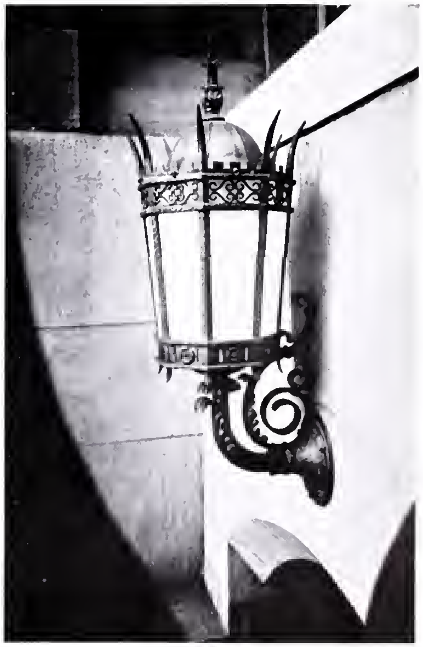


Fig. 11
Hand-wrought Monel Metal lighting fixture. St. Ignatius Loyola Church, New York. Designed by Maginnis & Walsh, Architects.

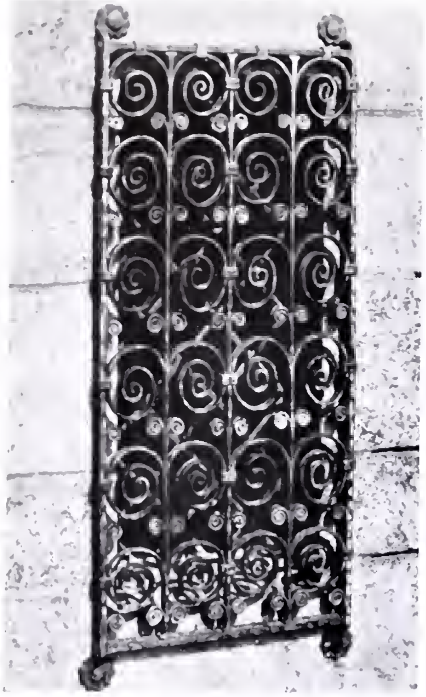


Fig. 12
Wrought Monel Metal window grille made in church workshop. Bryn Athyn Church, Bryn Athyn, Pa.

When cleaning is necessary, it will be found that Monel Metal retains no deep tarnish marks but, can be restored to its original finish with a minimum of effort and by the use of ordinary cleansers. Unquestionably, Monel Metal stands high among all white metals in the ease with which it can be cleaned and kept bright, for under no conditions can the metal rust nor does it ever corrode or tarnish to such a degree as to require expensive polishing methods unless it is utterly neglected over long periods of time.

Architects should pay particular attention to the problem of cleaning white metals, for there is much confusion and misinformation current on this subject. Every metal must be cared for to a greater or lesser extent if the designer's original effect of color, texture and reflectivity is to be maintained indefinitely. The only matter of importance is the relative frequency and ease of cleaning the various metals. Studies of the properties of Monel Metal under all conceivable conditions of exposure and uses over a period of more than thirty years show that it is entirely satisfactory with respect to the care required to keep its surface in the desired condition.

Forms in which Monel Metal may be Used

Another phase of the personality of any metal is its adaptability to various methods of fabrication and the variety of shapes and forms in which the metal may be employed. Monel Metal can be fabricated in every manner known to the art with the sole exception that it cannot be extruded. It may be forged, cast, repoussé, chiseled, inlaid, turned, machined, drawn, rolled, engraved, etched, and cloissonné and champlevé enameled. In short, the entire art of the metal craftsman can be employed in developing decorative or utilitarian products of Monel Metal so long as extruded patterns are not demanded by the designer.

This fact that Monel Metal cannot be extruded because of its strength at high temperatures is of great importance in understanding the proper use of the material in architectural work. The matter will be more fully developed in subsequent chapters on fabrication and design. This limitation is important here, however, because it contributes an element to the personality of Monel Metal; for it establishes the necessity for creating patterns having sharp arises by building up the pattern of rods or sheets, or by machining. Naturally, therefore, the tendency in designing with Monel Metal is to use sharp arises only when the employment of these shapes or of machine products is both logical and economical, and to employ slightly curved arises at other points, such as can be produced by drawing or bending the sheet metal.

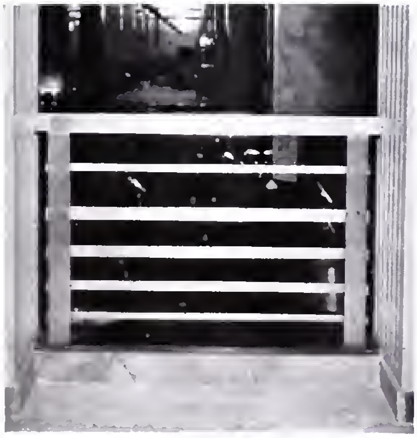


Fig. 13
Monel Metal railing built up of plates and rods in T. Eaton Store, Toronto. Designed by Ross & MacDonald, Architects, Montreal; Sproatt & Rolph, Associate Architects, Toronto. Executed by Architectural Bronze & Iron Works, Toronto.

Intelligent and sympathetic handling of Monel Metal design thus acquires a characteristic which distinguishes the pattern somewhat from that commonly found in designs that are to be produced in bronze, brass, aluminum or any of the other metals that are extruded. This by no means imposes any severe limitation upon the designer's scope, but it makes it highly advisable to avoid attempting the substitution of Monel for an extrudible metal in any design work that employs a quantity of extruded shapes. The cost of reproducing these shapes in built up or machined sections of Monel Metal often places this metal out of reach of the architect or his client when more sympathetic handling of the design would permit the elimination of extruded elements and would bring the cost of Monel Metal work down to such a point that its use would no longer be a question of expense.

Period Designs in Monel Metal

Though Monel Metal is a "natural" alloy and other nickel-copper alloys have been known to mankind throughout many centuries, there is an unfortunate tendency to think of Monel Metal as being appropriate only to modernistic work. Since packfong was employed by Chinese potters as an intriguing inlay, white metals have been used by designers in all architectural eras, though often the white effect was produced by covering the base metal with silver. There is ample precedent for the use of white metals in period designs, even though there may be a seeming paucity of precedent for the use of Monel Metal in this manner.

However, designers should appreciate that Monel Metal is actually a superior "substitute" for wrought iron and for other baser metals that were used in earlier days. Wrought iron patterns worked in Monel Metal have a crispness, brilliance and beauty that craftsmen always seek in wrought iron work but never realize so fully as they can now attain it by using Monel Metal for this purpose. When desired, the Monel Metal wrought work may be left in its oxidized finish as it comes from the forge; or it may be ground to give bright highlights with oxidized hollows. A few examples of fine wrought Monel Metal work are presented in this book, showing how period wrought iron details have been recreated in this relatively modern material, with greater brilliance of execution than is to be seen in the precedents which inspired the designers.

Similarly, Monel Metal may with all propriety be used in place of silver or baser white metals for cast ornaments, for lighting fixtures, repoussé work and for chased and embellished ecclesiastical details and domestic furnishings and accessories.

Monel Metal in Modern Design

There is such universal recognition of the appropriateness of Monel Metal to the development of modern design themes that no discussion of this use of the material is required. To such an extraordinary extent has this metal been adopted by the famous craftsmen and architects of the present day that the great majority of illustrations in this book show Monel Metal in modern design forms.

The Personality of Monel Metal

This resume of the characteristic attributes and behavior of Monel Metal summarizes those qualities and distinguishing properties of the material that constitute what we here term its "personality." Only when the designer keenly feels and understands this personality—whether it be of Monel Metal or of any other material in which he proposes to crystalize his design conceptions—can he give force, originality and fitness to the detail as created.

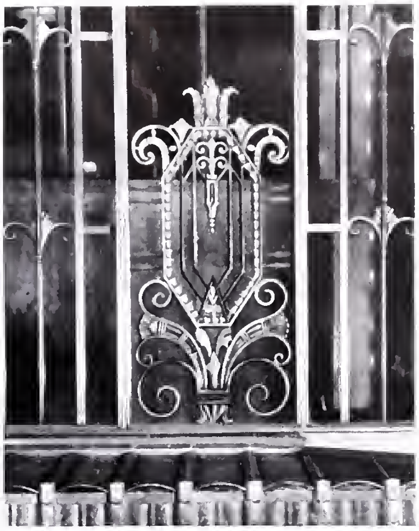


Fig. 14
Cast ornament used with solid rods in grille over entrance of T. Eaton Store, Toronto. Designed by Ross & MacDonald, Architects, Montreal; Sproatt & Rolph, Associate Architects, Toronto. Executed by Architectural Bronze & Iron Works, Toronto.

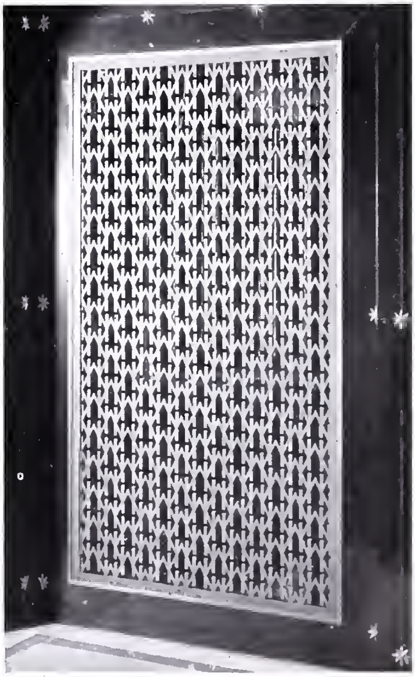


Fig. 15
Radiator grille of cast Monel Metal in the Wall and Hanover Building, New York. Designed by Delano & Aldrich, Architects, New York. Executed by The Elevator Supplies Co., Hoboken, N. J.

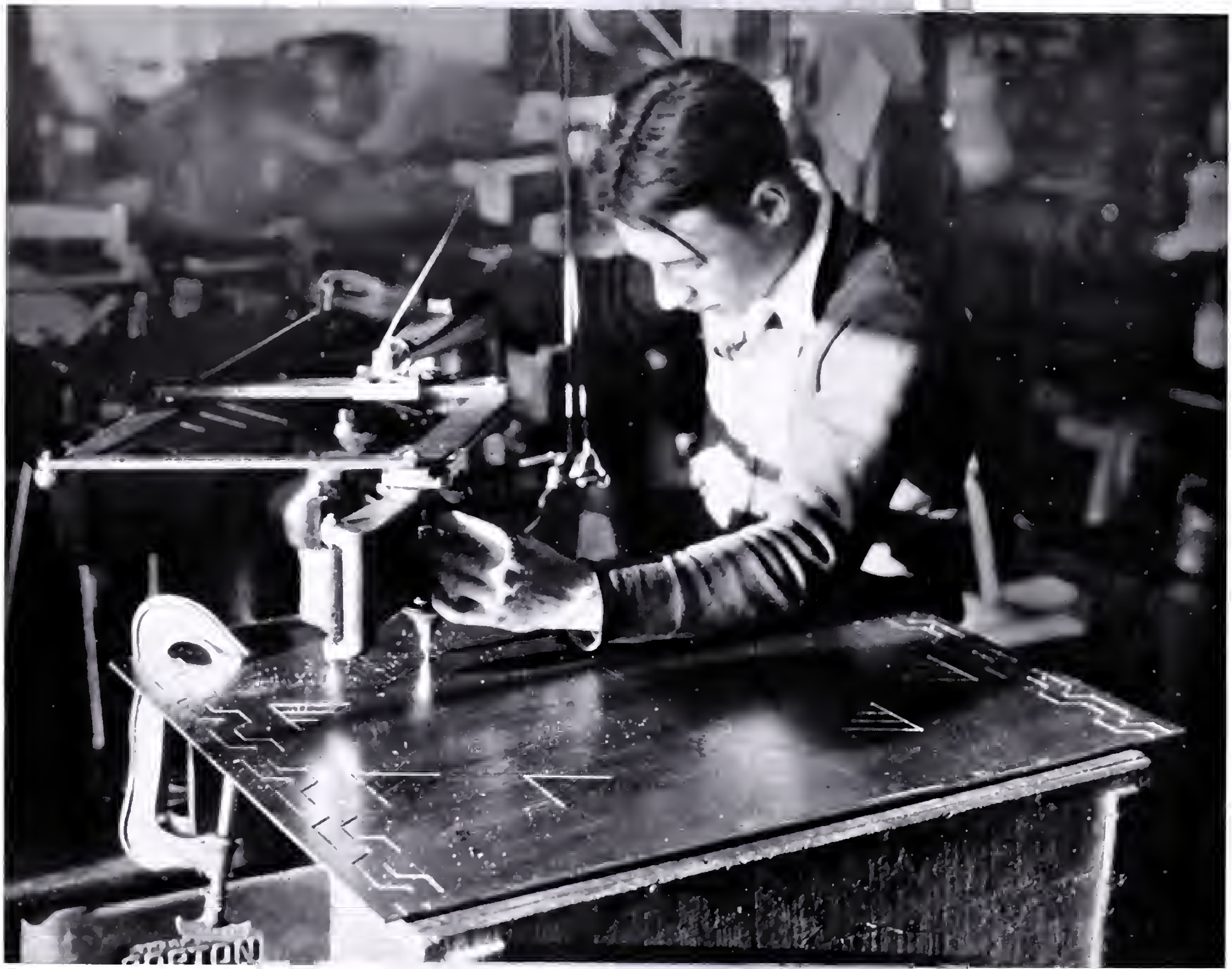


Fig. 16

Machine engraving offers unusual possibilities for the development of modernistic details in Monel Metal. This method was widely used in fabricating architectural metalwork for the Union Trust Company Building, Detroit A Gorton pantograph engraving machine is shown working from a master plate in the shops of The Gorham Co., Providence, R. I.

Practical Craftsmanship in MONEL METAL

ART and craft are complementary and inseparable forces in all forms of successful creative work. It is futile for the artist to envision what the craftsman cannot create. Successful design in Monel Metal thus requires an appreciation of the methods by which the artisan produces the desired result.

Scope of Fabrication Methods

The metal craftsman can work Monel Metal by every means known to his art, with the single exception that the extrusion process must be eliminated. This is an exceedingly important point for the architect or designer to bear in mind. It is the only restriction influencing the designer's work. In practice, however, it means that architects should not design for bronze, aluminum or some other extrudable metal, and then change over to Monel Metal without either modifying the extruded details in his composition or making arrangements to pay a premium for creating the same effects through the assembly of solid shapes, or through the use of castings and machine work.

Lack of appreciation of this simple point has led many architects to a belief that Monel Metal is an expensive material to use for decorative purposes. While Monel Metal is by no means to be classed as a cheap metal, nor to be compared with inferior metals or alloys, the relative ease with which it can be fabricated enables it to compete very closely with other quality metals if the craftsman is not called upon to do the impossible or to create, by assembly methods, elements that can be cheaply extruded in softer metals.

Forms in which Monel Metal is Available

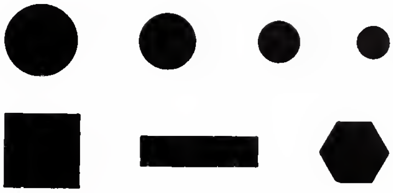
Before showing how Monel Metal may be fabricated to produce almost any conceivable design effect, it is important to discuss briefly the variety of shapes and forms in which the metal is available to the craftsman. The accompanying diagram graphically pictures the standard forms in which Monel Metal is produced at the mill. The following also shows the approximate range of dimensions in which each form is made. The forms are as follows:

Sheets range in thickness from .018″ to $\frac{1}{4}$″ (U. S. standard gauges 26 to 3). Full finished sheets can be obtained in widths from 24″ to 50″ and in lengths from 60″ to 172″ depending upon the gauge. Cold rolled sheets can be obtained in widths from 24″ to 44″ and in lengths from 60″ to 166″ depending upon the gauge. Full finished sheets can be secured in two finishes, (A) standard and (B) No. 8 satin grind finish. They are furnished in one temper only, soft annealed. Cold rolled sheets can be secured in two finishes, (A) cold rolled standard and (B) cold rolled and buffed finish.

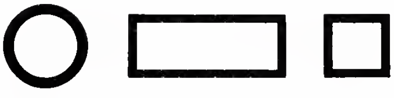
Strips are available in thicknesses from .015″ to .125″ (U. S. standard gauges 28 to 11), and in any required widths from 1$\frac{1}{2}$″ to 18″.

Plates range in thickness from $\frac{1}{4}$″ to 1″; in width from 18″ to 144″ and in lengths from 5′ to 30′, depending upon the thickness.

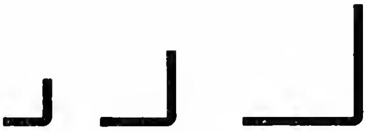
Sheets - Strips - Plates



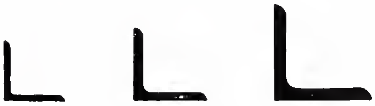
Rods and Flats
(Rounds-Squares-Rectangles-Hexagons)



Seamless Tubes
(Round-Rectangular-Square)



Cold Rolled Angles



Hot Rolled Angles

Fig. 17
Standard forms of Monel Metal.

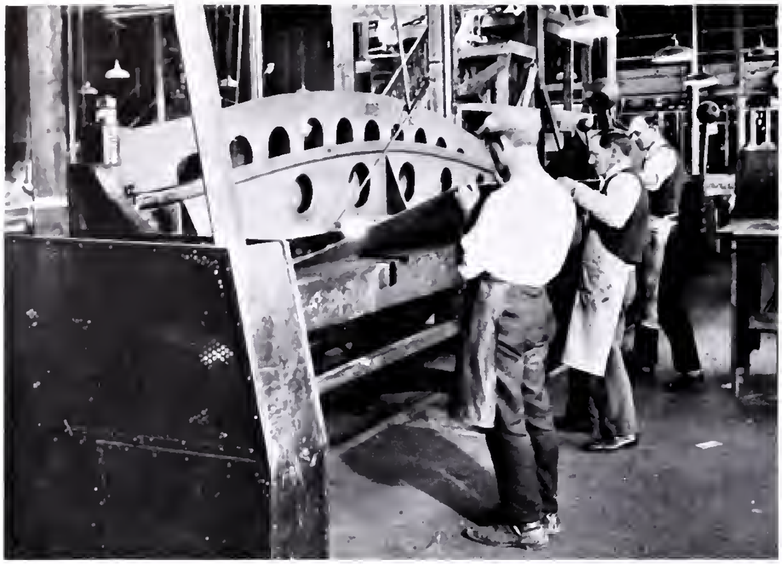


Fig. 18
Bending sheet Monel Metal in a power brake. Monel Metal may also be rolled, drawn and stamped.

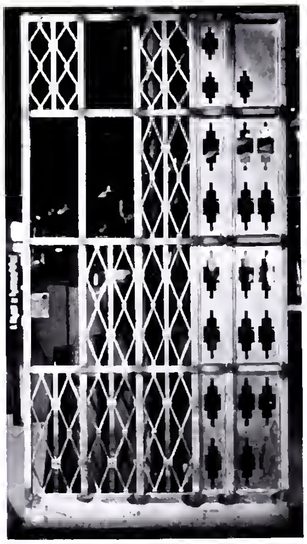


Fig. 19
Assembling a Monel Metal screen in the shop of the Gorham Company, Providence, R. I. Component parts assembled by electric welding.

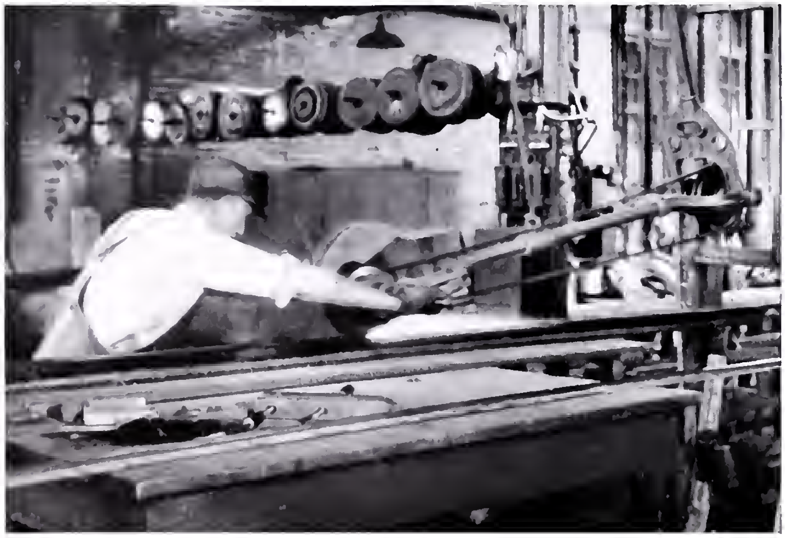


Fig. 20
Grinding weld points in a section of Monel Metal cornice for a bank counter screen.

Rods and flats, in the form of rounds, squares, hexagons and rectangles, are produced in a wide range of sizes.

Hot Rolled Angles are produced in several sizes from 1¼″ by 1¼″ by ⅛″ up to 3″ by 3″ by ⅜″ standard or square root.

Cold Rolled Angles are produced in several sizes from ½″ by ½″ up to 3″ by 3″. Two thicknesses are available for each size of angle .109″ and .062″.

Seamless Tubes are available in outside diameters from ¼″ to 4″ and with wall thicknesses from .035″ to .165″.

Square and Rectangular Tubes are also available, but as new dies are being added from time to time special inquiry should be made regarding requirements for this type of tubing.

The refined metal is, of course, available in ingots, shot, etc., for castings.

Methods of Working and Assembly

With these basic forms, metal craftsmen can create almost any design the architect may desire. The accompanying illustrations, Figures 18 to 23 show the commoner forms of fabricating decorative Monel Metal work. The normal processes include rolling, forging, casting, machining, etching (by chemical means) engraving (hand or mechanical), welding, brazing and soldering. Sand blasting has recently been employed on Monel Metal to produce decorative effects of unusual interest. The process is faster and usually cheaper than chemical etching. By varying the degree of polish and the amount of sand blasting in different parts of the design, the flat pattern can be given the effect of relief and color.

In most cases the methods employed with Monel Metal are similar to the methods employed with bronze, brass, wrought iron or steel. The few exceptions which influence cost and which the designer may recognize in his detail are referred to in the following chapter.

Economy in Production Depends upon Design

So far as possible, architects should

give their fabricators considerable latitude in the methods to be employed in fabricating Monel Metal parts, for each shop has its own way of assembling the units according to the equipment on hand, and the experience and skill of the craftsmen. It is seldom necessary to detail assembly methods. Very frequently costs can be reduced both in the architect's office and in the fabricating shop by omitting in specifications and drawings any fixed requirements concerning fabrication and assembly methods.

At the same time, architects can achieve their desired effect at minimum cost by so designing their work that all parts requiring sharp arises can be produced by the assembly of simple rods, flats and plates, and castings. Wherever extremely sharp arises are not essential, practically any desired shape can be created by drawing or bending the sheet metal. The radius of sharp corners produced by these processes can be reduced to less than the thickness of the metal by first scoring the sheet under the bend. In finished appearance, this process produces arises hardly to be distinguished from those obtained by extruding the metal.

At the same time, this method of design and fabrication tends toward real economy, because it uses far less weight of metal than is required by normal extruding processes. Since Monel Metal is exceedingly strong and rigid, and is able to withstand a great deal of wear and abuse, the employment of relatively light sheet metal in rolled, drawn or bent forms in no wise impairs the quality of the resulting work.

In fact, full recognition of the limitations imposed upon the fabrication of Monel Metal by its strength and permanency results in the creation of decorative forms of distinctive character that are wholly appropriate to the personality of the metal itself. Integrity of design is always impaired if the form does not truthfully express the material to the best advantage.

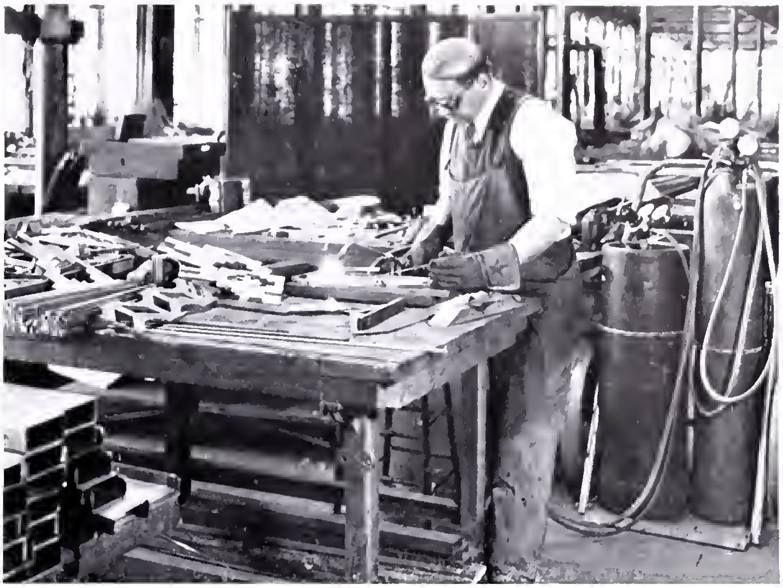


Fig. 21
Acetylene welding used in the fabrication of ornamental details in Monel Metal. Electric welding is also commonly used.

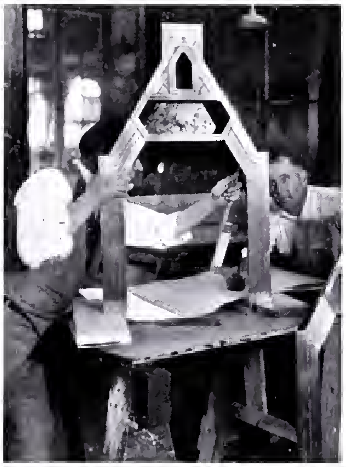
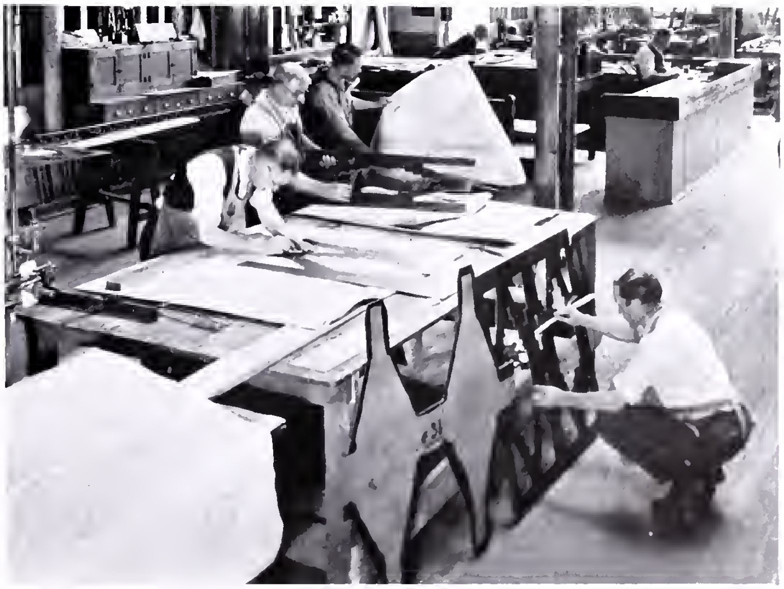


Fig. 22
Inspecting a finished counter screen wicket assembly. Note use of machine engraving.

Fig. 23
Laying out master patterns for a screen assembly made of perforated and machine engraved plates. Reproductions are made on pantograph machine.



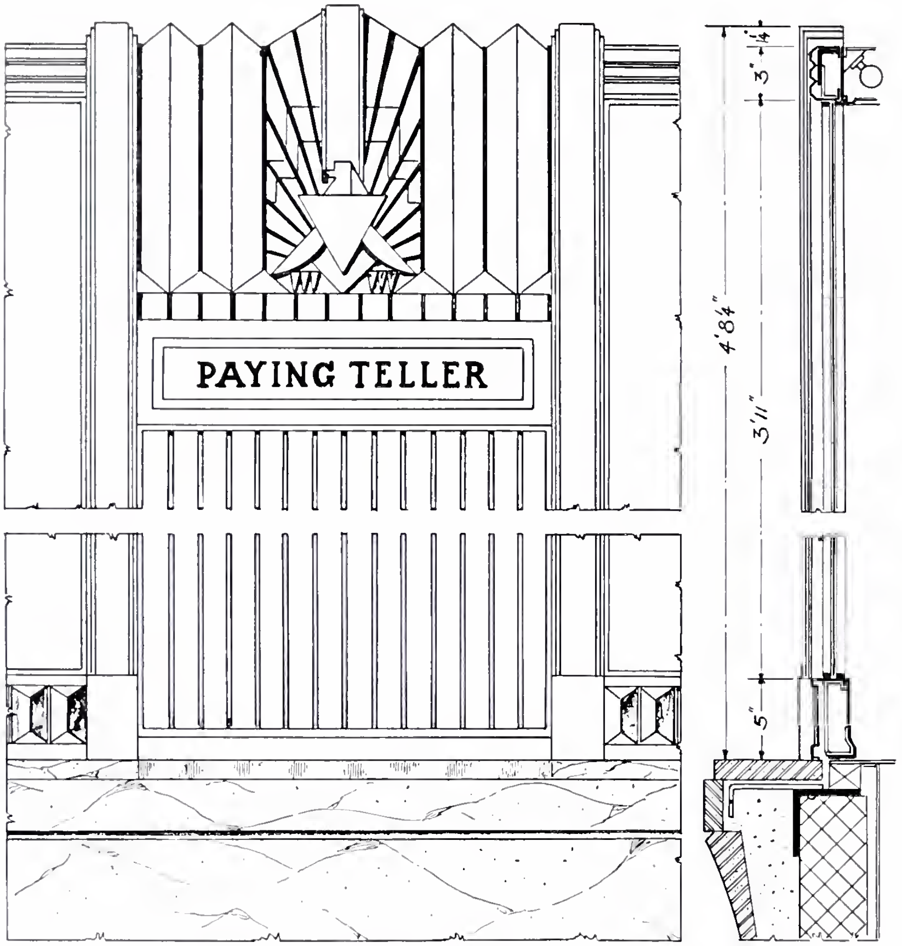


Fig. 24
Elevation and section of a bank screen and wicket. Fabricated from rolled Monel Metal strips, rods and tubes, with a decorative Monel Metal casting over the wicket. Pittsburgh Branch of the Federal Reserve Bank of Cleveland. Designed by Walker & Weeks, Architects. Executed by the John Harsch Bronze & Foundry Co., Cleveland, Ohio.

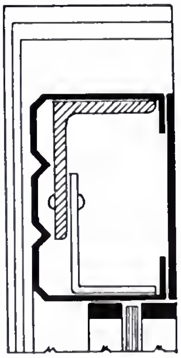


Fig. 25
Head of screen cold rolled from strip. Glass stops solid rods.

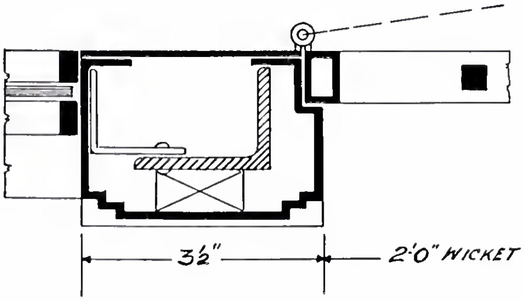


Fig. 26
Jamb of screen. The wicket frame is cold rolled from Monel Metal strip. Wicket is constructed of tubes and bars.

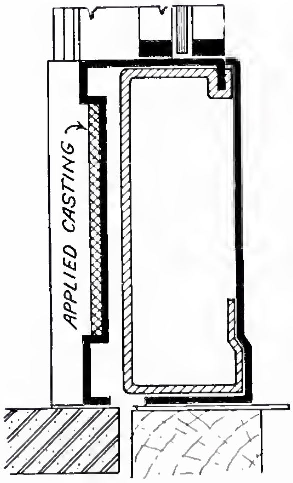


Fig. 27
Base of screen. Made of two pieces cold rolled from Monel Metal strip.

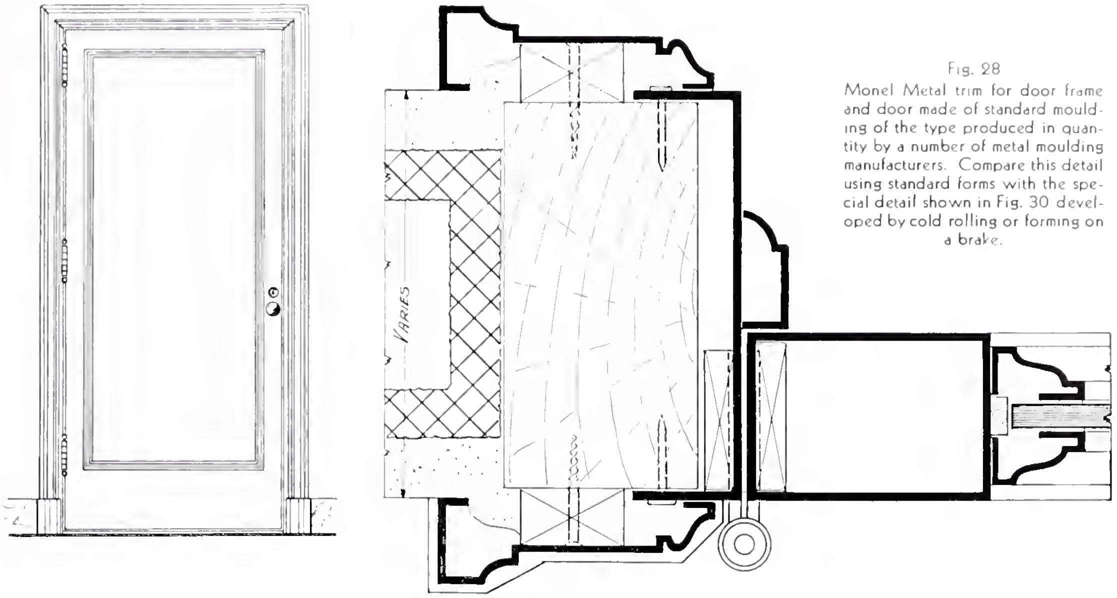


Fig. 28
Monel Metal trim for door frame and door made of standard moulding of the type produced in quantity by a number of metal moulding manufacturers. Compare this detail using standard forms with the special detail shown in Fig. 30 developed by cold rolling or forming on a brake.

Typical Methods of Fabricating Ornamental Details and Trim from Standard Monel Metal Shapes and Strips.

Most of the common forms of decorative metalwork may be fabricated from Monel Metal rods, sheets, plates, strip, tubes or angles. These illustrations show the solution of typical design problems largely developed from strip metal, either rolled or formed on a brake, eliminating the need for extruding special shapes, which can only be done with softer metals.

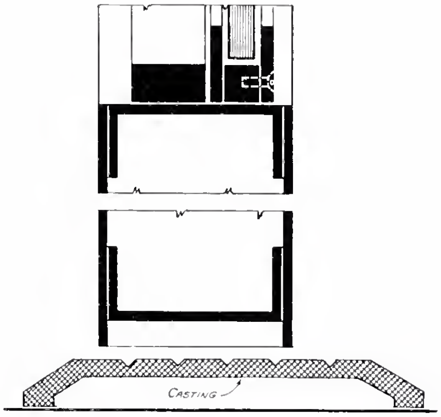


Fig. 29
Bottom rail of door shown in Fig. 30. Note method of assembling, using simple standard shapes. Threshold cast Monel Metal.

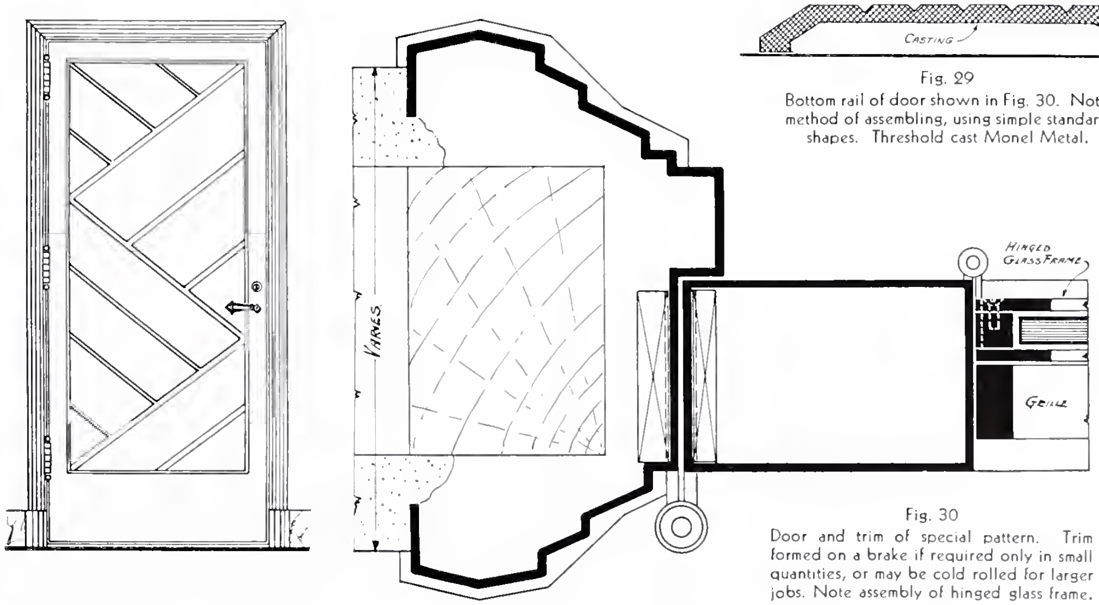


Fig. 30
Door and trim of special pattern. Trim formed on a brake if required only in small quantities, or may be cold rolled for larger jobs. Note assembly of hinged glass frame.

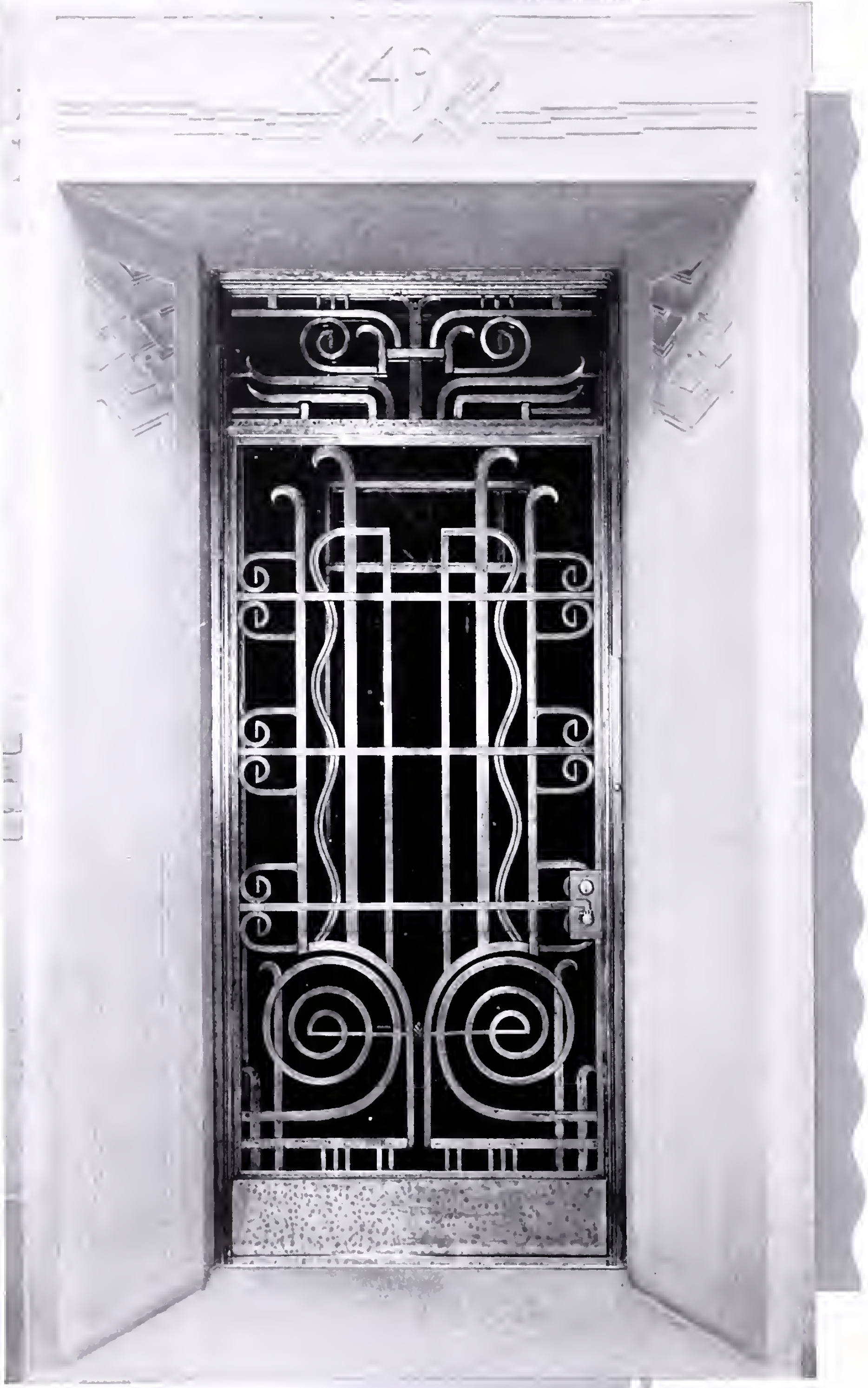


Fig. 31
Monel Metal may be forged like wrought iron, but produces results of greater brilliance and crispness. Entrance grille by Harry Allen Jacobs, Architect, New York. Executed by Renner & Maras, Inc., Long Island City, N. Y.

Practical Design in MONEL METAL

If it may be taken as an axiom that design forms should express the material employed, it is very easy to capture the spirit or personality of Monel Metal. Whether the form be developed by forging, casting, rolling, engraving, or any other appropriate fabrication method, the inherent properties of Monel Metal suggest to the designer appropriate and beautiful forms of expression. In this chapter consideration is given to practical methods of designing in Monel Metal which properly express both the material and the art of the craftsman without in the least manner limiting the breadth of the designer's conceptions.

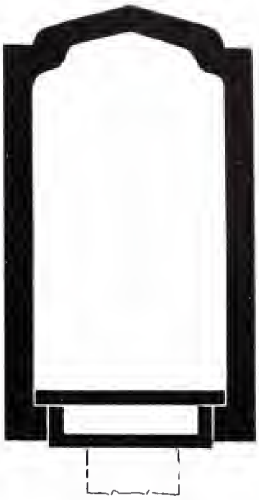


Fig. 32
Hand-rail employing extruded shapes as developed for bronze, aluminum or other extrudable metals.

Eliminating Extruded Shapes

The architect not accustomed to working in bronze or brass may feel somewhat hampered when working in Monel Metal, knowing that it is impossible to extrude this metal and relatively costly to reproduce certain complicated extruded shapes by other means. As a matter of fact, it is sometimes expensive to reproduce an element that was designed for fabrication by the use of extruded shapes, but it is neither costly nor difficult to achieve the desired effect in Monel Metal by entirely eliminating the extruding process.

Sharp arises characteristic of extruded shapes may readily be created by assembling the form with rods, flats, plates, strips, angles and other standard forms in which Monel Metal is available to the fabricator. Typical methods of avoiding extruded shapes will be seen in the illustrations on pages 22, 23, 30, 31, 33 and 36.

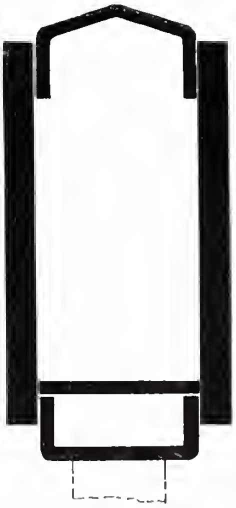


Fig. 33
The same hand-rail developed in Monel Metal without the use of extruded shapes. Crown and bottom channel formed on a brake. Other members flat bars.

Design of Forged Details

The methods of designing wrought iron details, which are so familiar to every architect, may be employed without modification when Monel Metal is to be used. Monel Metal is worked under the hammer in much the same way as wrought iron, except that it requires heavier hammering, because of its high strength at forging temperatures. It is advisable for the craftsman to employ low sulphur fuels for heating Monel Metal. Coal or coke forges, however, can be used if precautions are observed.

Designers will find that wrought details of Monel Metal can be developed with greater brilliance and crispness than is possible with wrought iron, and for that reason Monel Metal may be used as a substitute for wrought iron when superior results are desired.

Wrought Monel Metal details may be finished in a variety of ways. Forged work leaves Monel Metal with the same tool marks as are obtained on wrought iron, but in the heating preliminary to forging a black oxide appears on the surface. This oxide tends to adhere tightly to the metal and is not removed in the hammering process excepting when the metal is heated under strongly oxidizing conditions. In this case, it is partly but not wholly removed by the hammering process.

By grinding and buffing to bring out the highlights leaving the black color in the hammer marks, the effects of hammered wrought iron is obtained. This mottled finish is both handsome and durable.

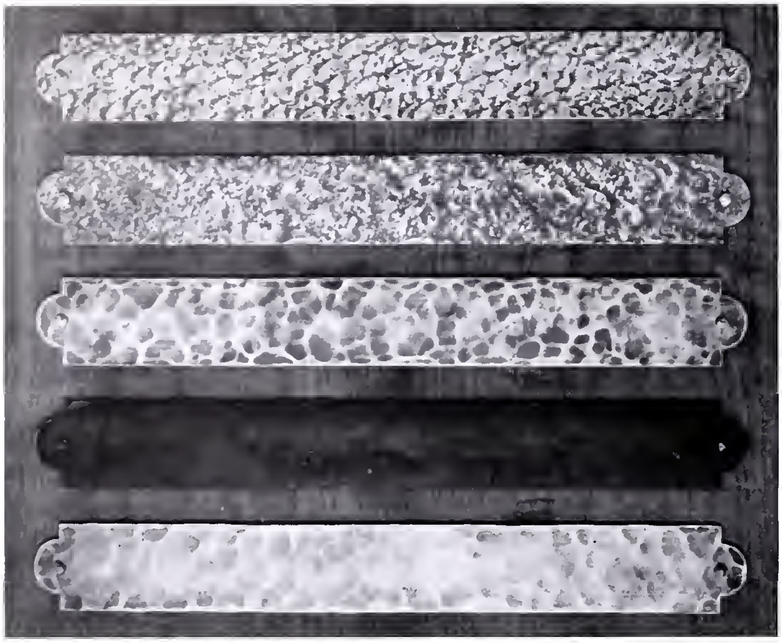


Fig. 34
Typical finishes on wrought Monel Metal. Texture effects vary with character of hammering. Color values vary with the amount of grinding or polishing. The dark strip shows the black oxide formed during forging, which may be left as a durable finish or partially removed

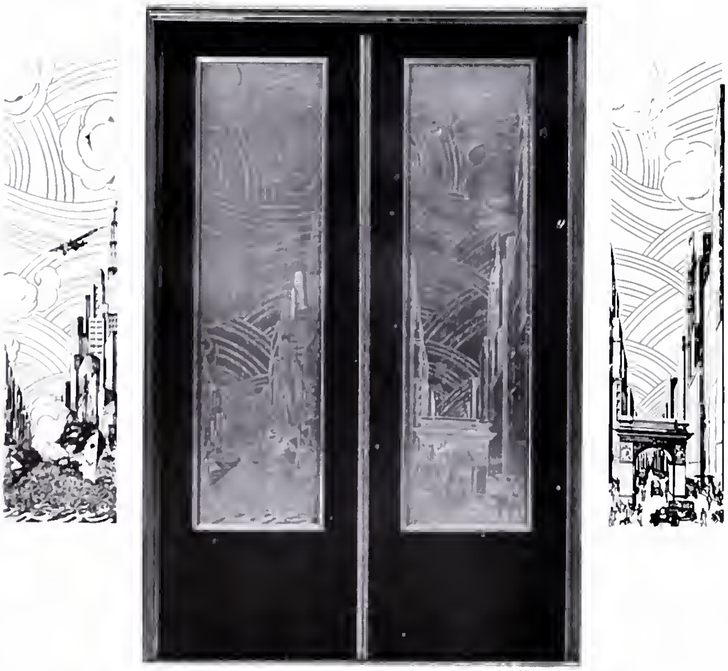


Fig. 35
Etched Monel Metal panels and trim in entrance doors to Broadway National Bank & Trust Company, New York. Architect's original drawings shown at sides. Architect Louis H. Friedland, New York. Executed by Superb Bronze & Iron Co., Brooklyn, New York.

All over bright finishes may be obtained by the usual grinding and buffing methods.

Specification Data: When specifying forged work of Monel Metal, normal wrought iron specifications should be modified to include the following: *Materials:* Forged details of Monel Metal shall be worked from hot rolled rods, flats or plates. Heating and forging shall be done in accordance with the practice recommended by The International Nickel Company.

Designing Cast Monel Metal Details

Deviation from standard practice in the design of cast details is not ordinarily required with Monel Metal. Moulding and foundry practice is changed to accommodate the higher temperature of melting and pouring of Monel Metal and to provide for its greater shrinkage. The International Nickel Company maintains a staff of practical foundrymen to assist in casting problems.

Castings may be finished in any of the usual ways, such as by machining, grinding, sand blasting, wire brushing and polishing.

Specification Data: Detailed specifications may contain the requirement that Monel Metal castings shall be made under the conditions and following the methods recommended by the technologists of The International Nickel Company. All castings shall be made of new metal.

Etched Work on Monel Metal

In spite of the high corrosion resistance of Monel Metal and its immunity to attack by ordinary acids and alkalis, an etching fluid has been developed for producing superior results on Monel Metal. Standard practice is used in the design of etched work and any depth of etching normally used on decorative metal work may be produced on Monel Metal. The etching is clean and crisp, and leaves a finished surface resembling fine sand blasting. This surface may be reduced to a polished finish in the customary ways, or may be left as a decorative surface to contrast with the bright finish of the untouched parts.

Engraving on Monel Metal

Very brilliant and beautiful results can be achieved by hand or machine engraving on Monel Metal. Except for the most elaborate detailed work, machine engraving, employing a pantograph device similar to that illustrated in Figure 16 is customarily used. The architect produces his pattern in the form of the customary line drawing. Where only a single reproduction of the pattern is required, the latter is transferred to the sheet and the routing tool runs over the lines to the required depth. If identical patterns are to be reproduced a number of times, the engraver first makes a master pattern and works from this with the pantograph. Much of the work on the bank screens in the Union Trust Building at Cleveland was performed in this manner.

Specification Data: No special instructions are required. It is customary to use full finished sheets for this type of work, but any other form of Monel Metal may be employed.

Designing Drawn Shapes

Monel Metal strips may be drawn through roller dies in the manner customarily employed for drawing steel and bronze. A great many shapes are commercially produced by manufacturers of metal mouldings and store fronts. The drawing process is economical if the fabricator can use existing rolls or if sufficient footage of work is required to offset the cost of making special tools. Monel Metal is ductile and entirely amenable to drawing.

Specification Data: No special instructions required. The fabricator should be permitted to use Monel Metal of appropriate temper and specifications should be confined to the desired finish. (*Continued on page 34*)

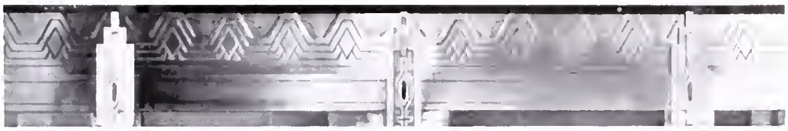


Fig. 36
Engraved Monel Metal trim with applied detail built up of plates.

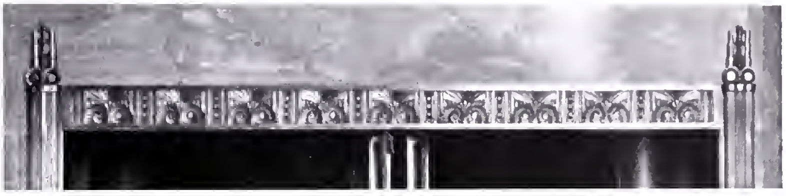


Fig. 37
Decorative heading of cast Monel Metal. Jambs trimmed with rolled strip and cast finials.

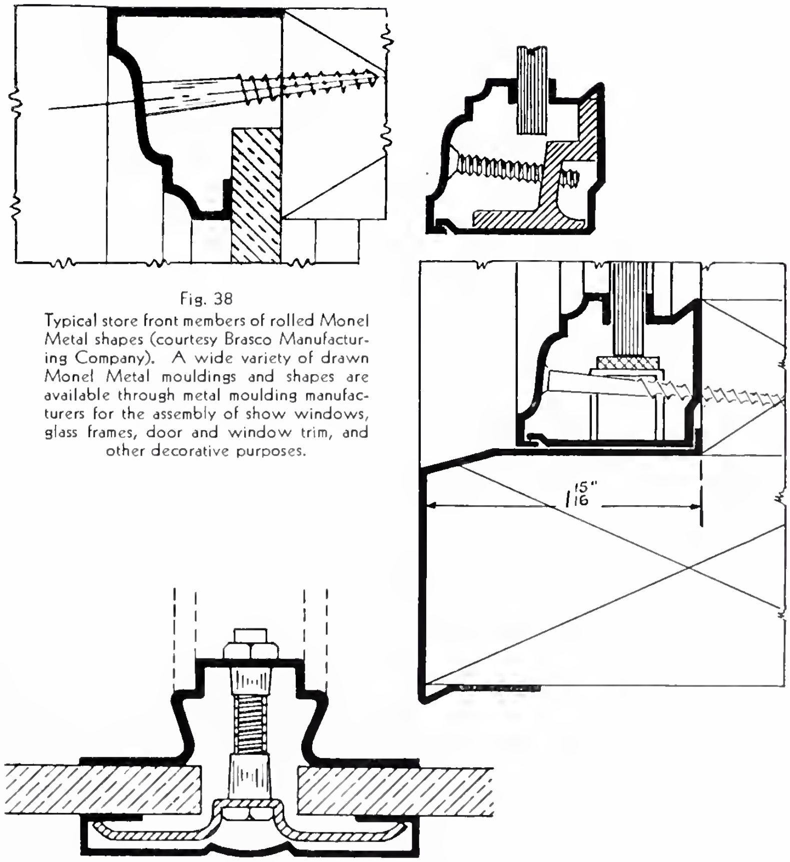


Fig. 38
Typical store front members of rolled Monel Metal shapes (courtesy Brasco Manufacturing Company). A wide variety of drawn Monel Metal mouldings and shapes are available through metal moulding manufacturers for the assembly of show windows, glass frames, door and window trim, and other decorative purposes.

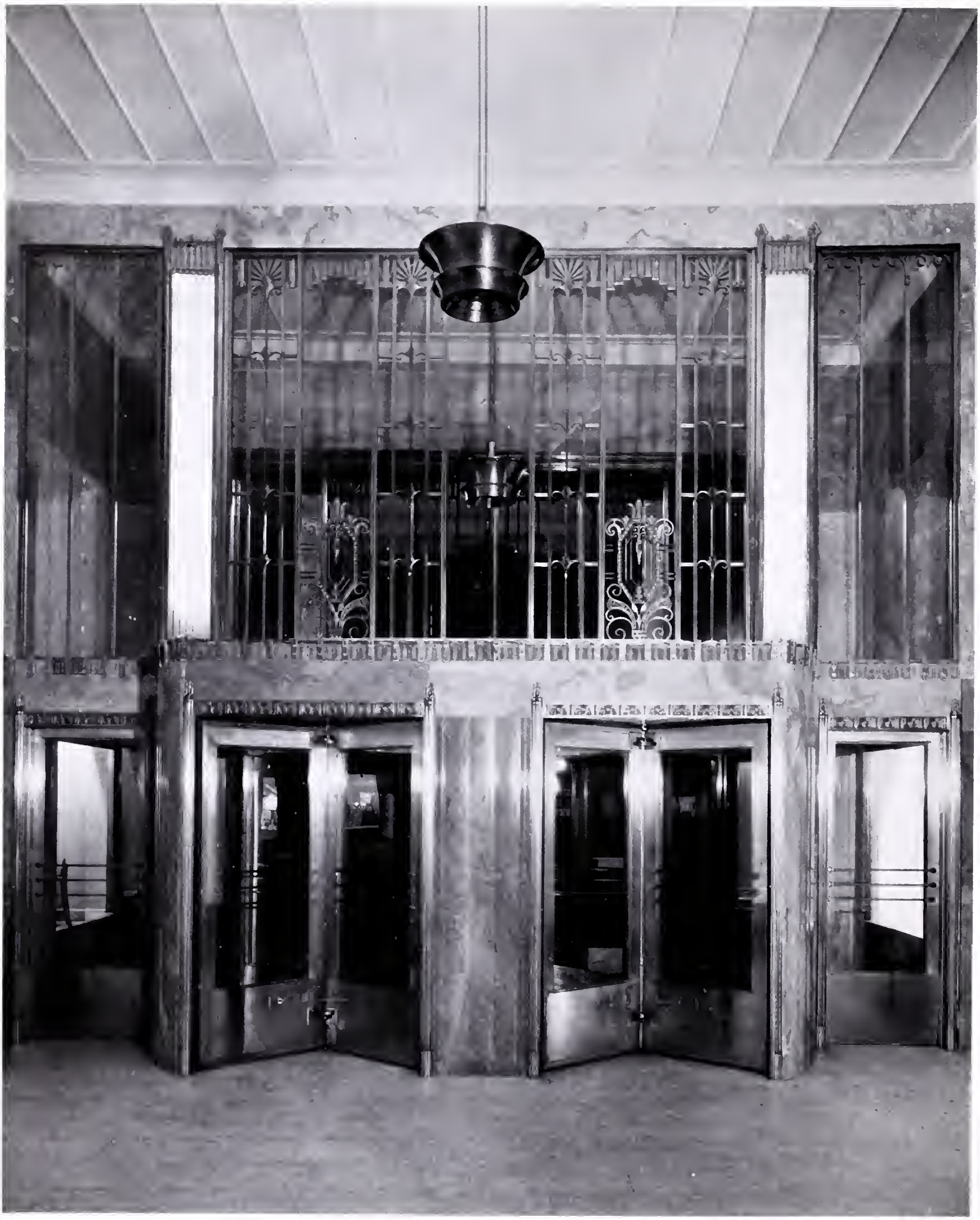


Fig. 39
Vestibule entrance developed entirely in Monel Metal, marble and glass. Department store of T. Eaton Company, Ltd., Toronto, Canada. Architects, Ross & MacDonald, Montreal. Sproatt & Rolph, Associate Architects, Toronto. Executed by Architectural Bronze & Iron Works, Toronto.

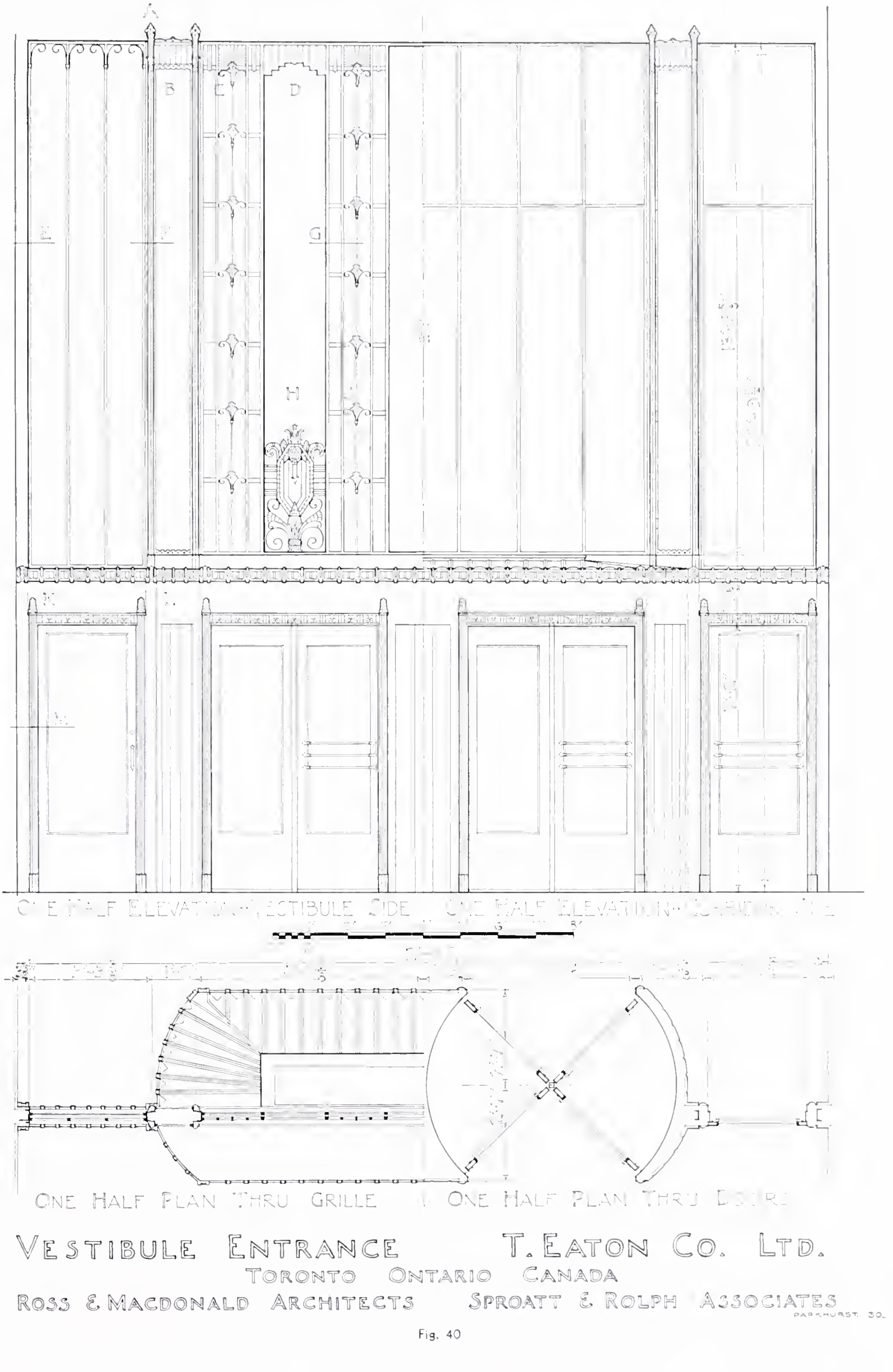
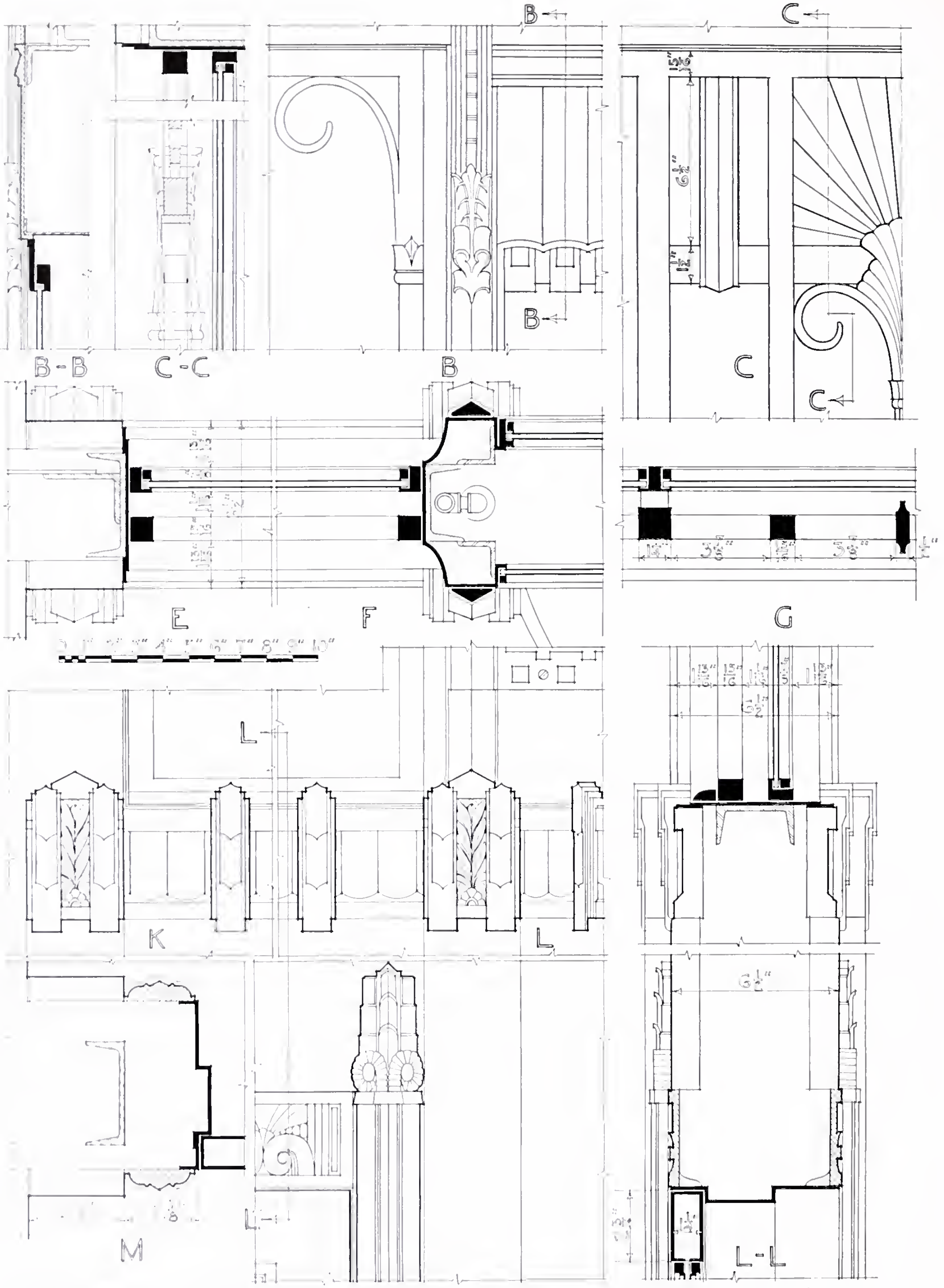
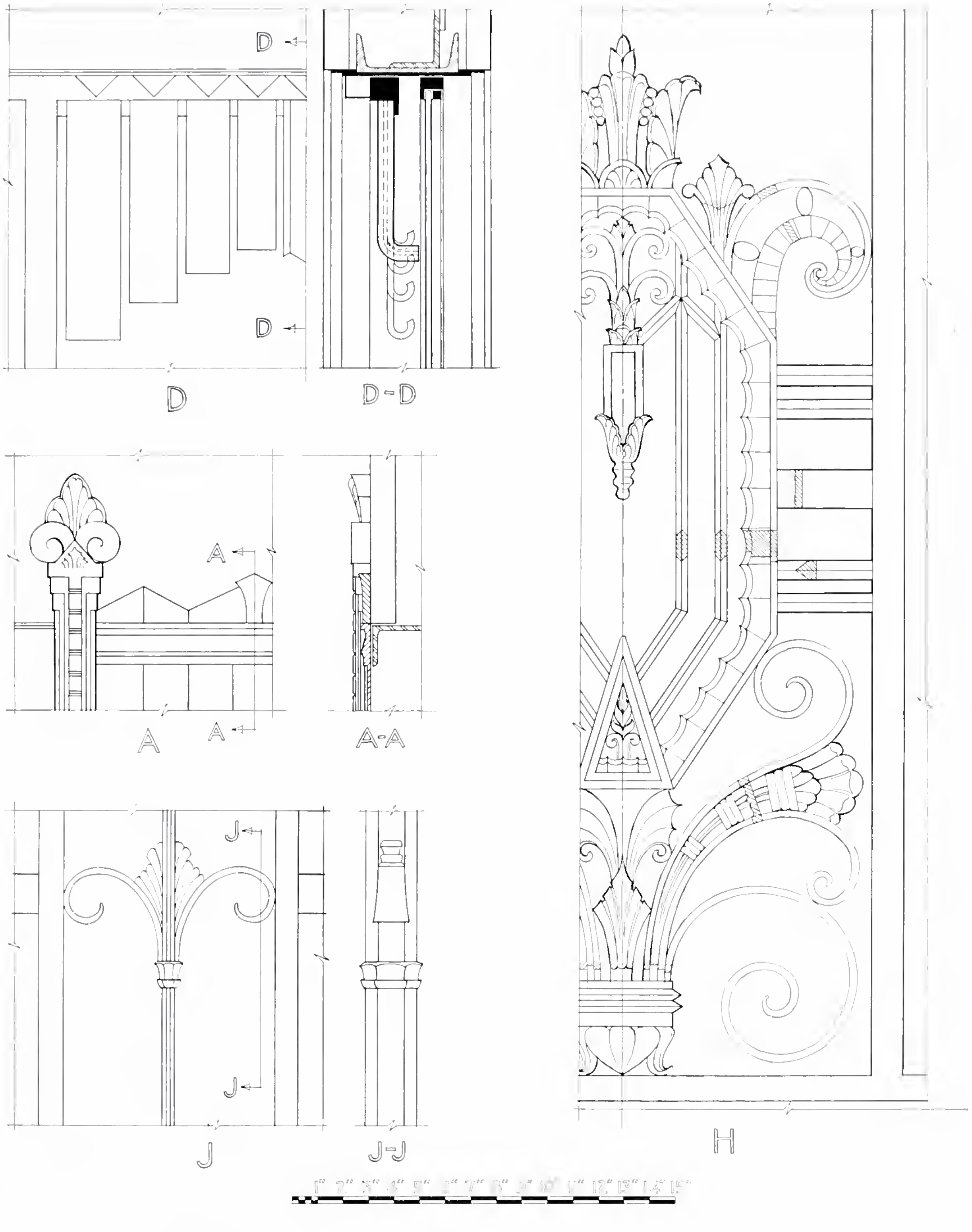

A
B
C
D
E
F
G
H
One Half Elevation Vestibule Side
One Half Elevation Corridor Side
One Half Plan Thru Grille
One Half Plan Thru Doors
Vestibule Entrance T. Eaton Co. Ltd.
Toronto Ontario Canada
Ross & Macdonald Architects Sproatt & Rolph Associates
Parkhurst 30.

Fig. 40



VESTIBULE ENTRANCE DETAILS T. EATON CO. LTD.
TORONTO ONTARIO CANADA
ROSS & MACDONALD ARCHITECTS SPROATT & ROLPH ASSOCIATES
PARKHURST '30

Fig. 41



VESTIBULE ENTRANCE DETAILS T. EATON CO. LTD.
TORONTO ONTARIO CANADA
ROSS & MACDONALD ARCHITECTS SPROATT & ROLPH ASSOCIATES
FAIRHURST '30

Fig. 42

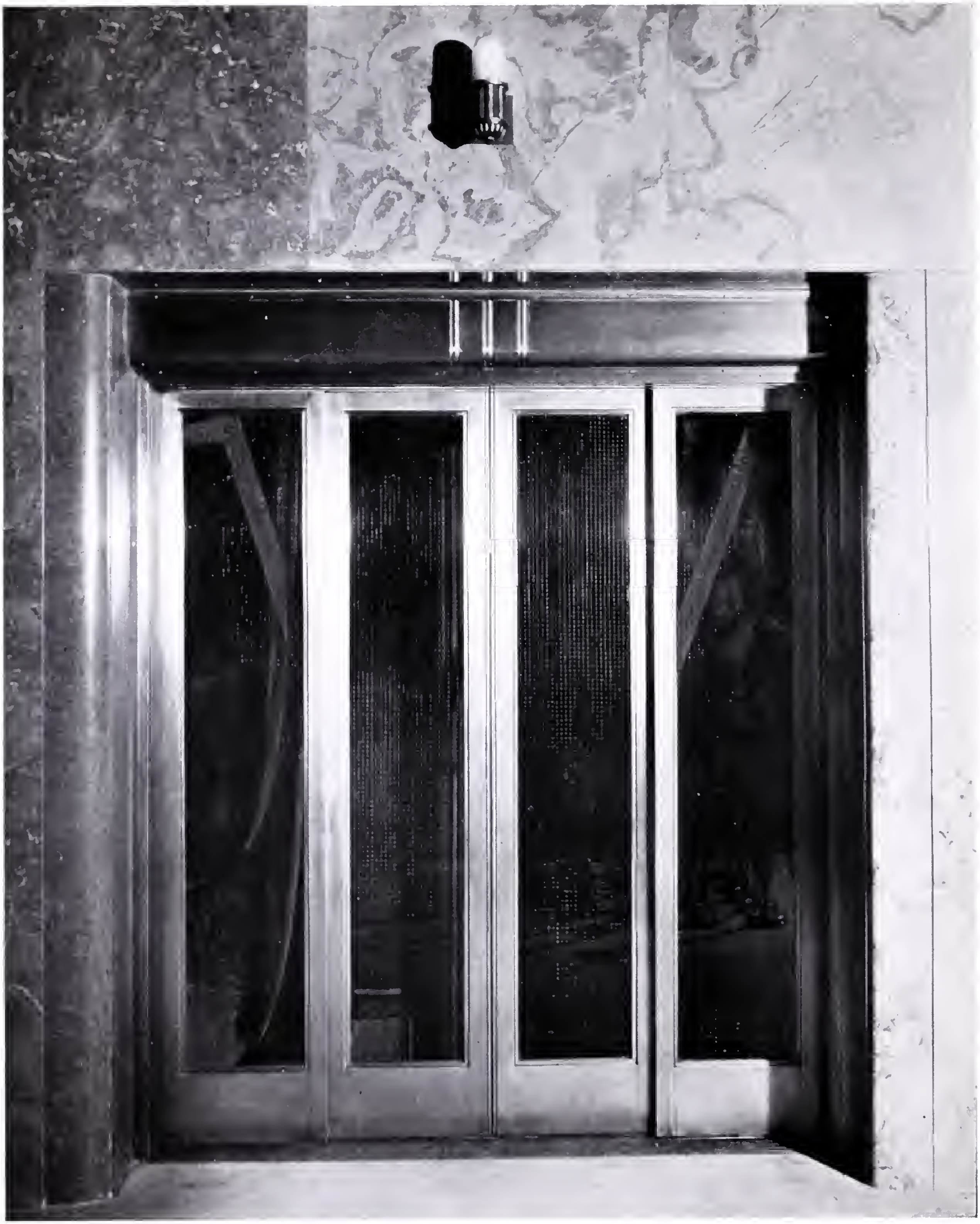
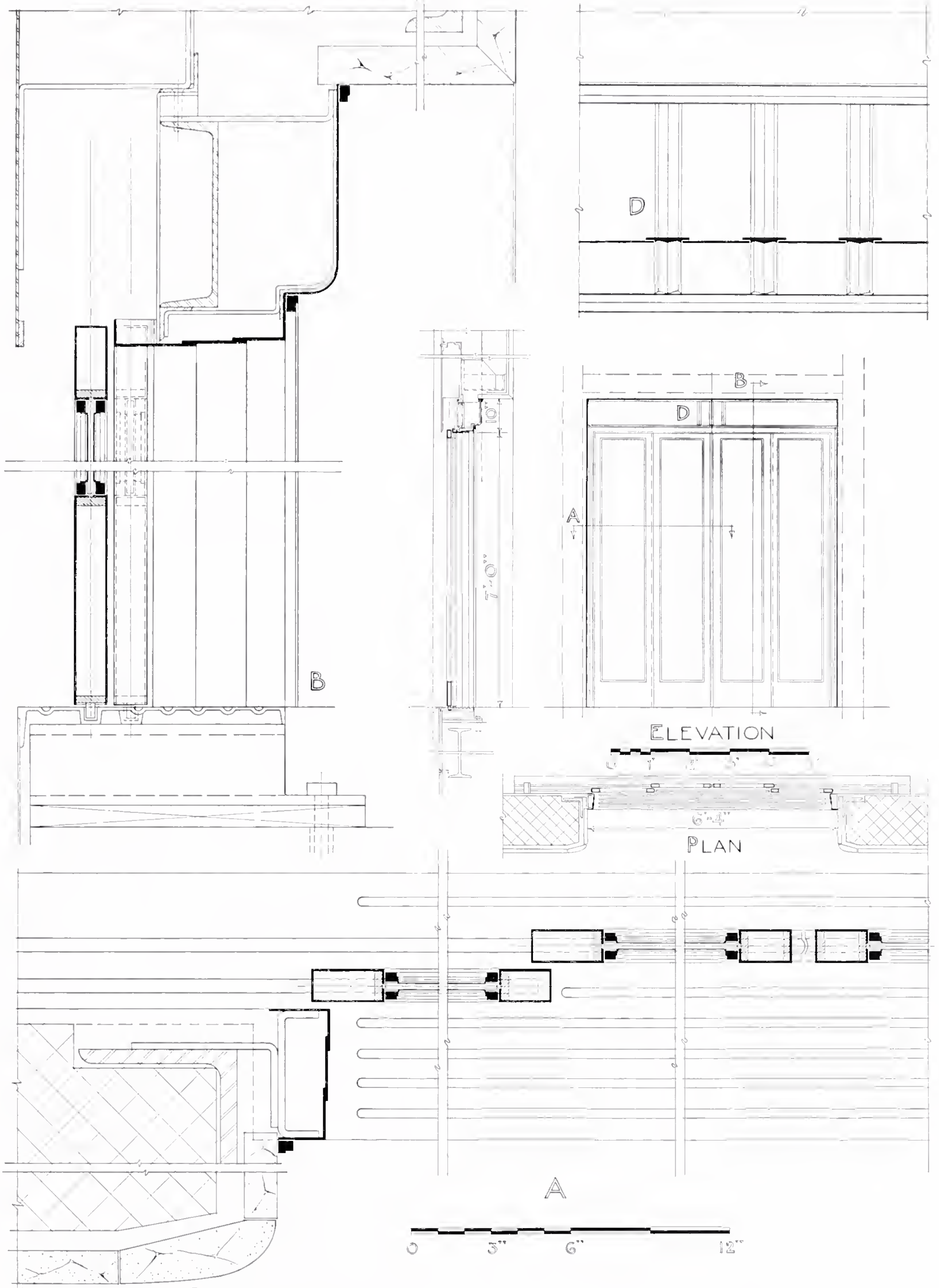


Fig 43

Elevator doors and trim of Monel Metal in the T. Eaton Company, Ltd. department store, Toronto, Canada. Architects, Ross & MacDonald, Montreal, Sproatt & Rolph, Associate Architects, Toronto. Executed by Architectural Bronze and Iron Works, Toronto.



ELEVATOR DOOR & JAMB DETAILS T. EATON CO. LTD.
TORONTO ONTARIO CANADA
ROSS & MACDONALD ARCHITECTS SPROATT & ROLPH ASSOCIATES
PARKHURST '30.

Fig. 44

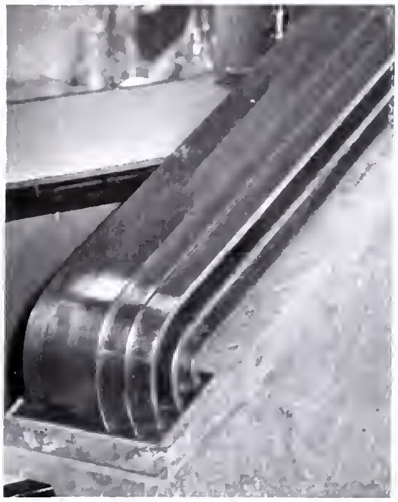


Fig. 45
Hand-rail formed by superimposing Monel Metal strips

Special Rolled Shapes Not Advisable

While there is a steady tendency toward the mill production of an increased variety of rolled Monel Metal shapes, the cost of producing special rolled shapes is prohibitive for ordinary architectural work. Before considering the use of special rolled sections, consult The International Nickel Company.

The need for special rolled shapes is easily obviated by machining the nearest shapes commercially produced or by assembling existing shapes as described above with reference to the elimination of extruded forms and as mentioned again below.

Designing Built-up Sections of Flats, Rods, Angles and Tubes

A great many structural and decorative elements can be formed of the assembly of flats, rods, angles and tubes in appropriate combinations. Note the detail shown in Figure 41 of a typical frame to carry plate glass, such as might be used in a bank screen. The main body of this frame can be created in two ways, either by taking a square rod and milling out the rabbets for the glass, or by developing "L" shaped section by welding or brazing a square to the edge of a flat section. The glass stop in this design is made of a square rod.

This type of work is vastly simplified by the fact that Monel Metal is readily brazed, soldered or welded and that these processes can be finished off so that the joints are practically invisible. The designer should give the artist considerable leeway in the development of forms employing this method of assembly, for the utility of the method depends upon the equipment at hand. The relative cost of machining, drawing or assembling units is the governing factor, because appearance and strength are not affected to any appreciable degree by the method of fabrication.

Specification Data: No special instructions are needed beyond general instructions which may be incorporated in thoroughly detailed specifications concerning the use of brazing, soldering or welding.

Repoussé, Enameling and Other Processes

Monel Metal is amenable to decorative treatment by all other known forms of metal working, including spinning, repoussé and stamping. The metal can be deeply drawn, using appropriate dies and sufficient power, with intermediate annealings to keep the metal from becoming too hard. Monel Metal also may be decorated by various enameling processes, including hard-baked enameling.

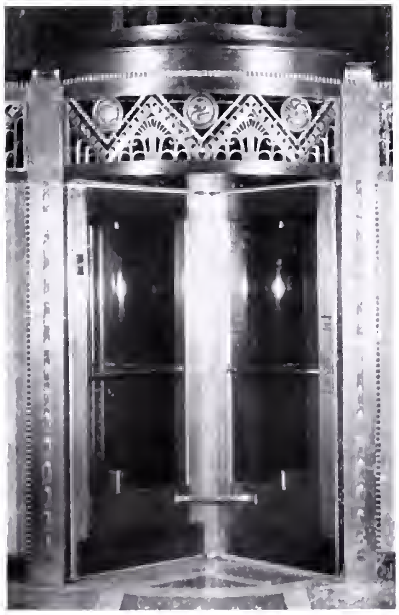


Fig. 46
Entrance doors and cresting of Monel Metal in combination with bronze in foyer of Integrity Trust Company. Paul Philippe Cret, Architect. Executed by Wm. H. Jackson Co., Brooklyn, New York.

Employing Monel Metal with Other Decorative Metals

Very beautiful results can be achieved by combining the brilliant white of Monel Metal with bronze, copper and brass. For decorative purposes where the work is exposed in ordinary atmospheres and where cleaning compounds are used with suitable care, Monel Metal can be combined with any other desired metal.

Since Monel Metal can be welded, soldered or brazed without difficulty, the method of joining this metal to other decorative metals is governed largely by the limitations imposed by the other materials. Normally, hard or soft soldering or brazing are used in this work.

Wire Brush Finishes on Monel Metal

One precaution regarding the finish of Monel Metal should here be called to the attention of the designer. Wire brush finishes are frequently employed on decorative metal work to bring out the self-color of the metal by the use of a finely grained surface instead of a highly reflective surface that picks up the color of surrounding objects.

Wire brushing can be accomplished on Monel Metal with great ease, but experience has shown that the brushes employed should themselves be made of Monel Metal. The reason for this is that in at least one instance where steel wire brushes were employed, fine particles of steel remained embedded in the tough surface of the Monel Metal where they eventually rusted, creating a mottled appearance that was very unsatisfactory. These particles of steel can be eliminated by etching them out with an acid to which Monel Metal is resistant, but the extra cost of this work can be entirely eliminated by specifying that "*all wire brushing shall be done with Monel Metal brushes.*"

Modern Design Motifs in Monel Metal

There is very general recognition of the appropriateness of Monel Metal to decorative compositions of modernistic architectural character. So broad is this recognition that the majority of the illustrations in this book show work in the modern spirit. The design motifs now so widely used are entirely in harmony with the personality of Monel Metal so that particularly happy results are usually achieved with this material in this form of expression.

Monel Metal in Period Design

This predominant use of Monel Metal in modern design themes should not blind the architect to the extraordinary potentialities of the metal for period designs. Mention has already been made of the fact that Monel Metal is more satisfactory for wrought iron details than wrought iron itself. It is not only more brilliant in its crispness and perfection of form, but it is more durable and has greater strength than wrought iron for such uses.

Similarly Monel Metal may be employed for architectural details and accessories that in earlier periods were worked in baser metals and finished in color or plated with silver. The workability of Monel Metal, its absolute permanence, its physical strength and its resistance to deterioration or wear in any form commends its use for all types of metal work involving fine craftsmanship.

Architectural Accessories of Monel Metal

All manner of architectural accessories may be designed in Monel Metal and many of them can be obtained commercially through manufacturers of standard products such as metal furniture, hardware and lighting fixtures. These accessories range all the way from the use of Monel Metal strips in terrazzo floors and Monel Metal inserts in tile or marble work to letter boxes, mail chutes, directory boards, elevator fittings, lighting fixtures, fireplace hardware and furniture. The designer can thus readily complete the composition in which Monel Metal is used for architectural ornamental details by repeating the same metallic color and finish in appropriate furnishings and accessories.

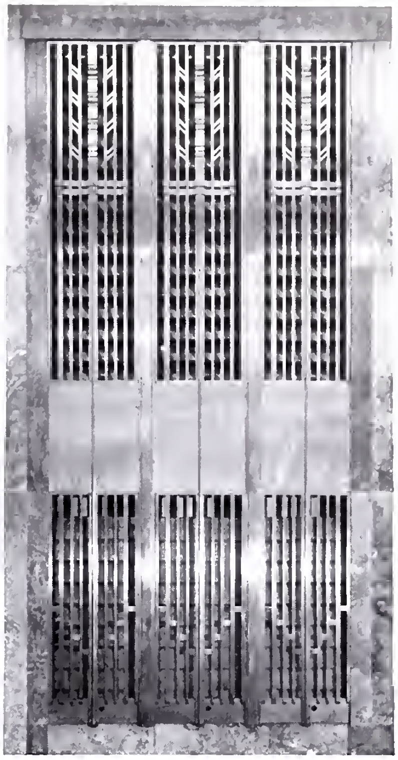


Fig. 47
Ventilating grille made entirely of standard rods and strips of Monel Metal.

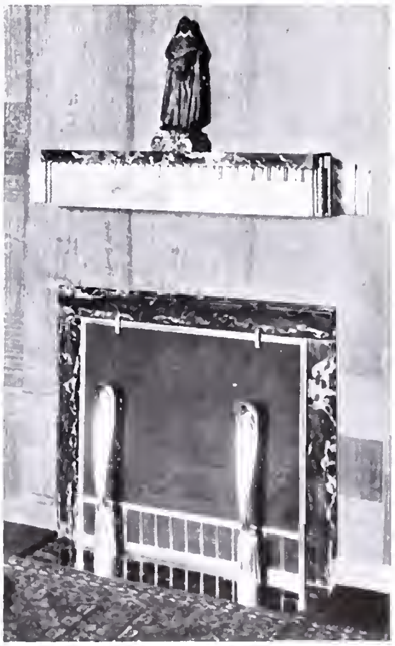
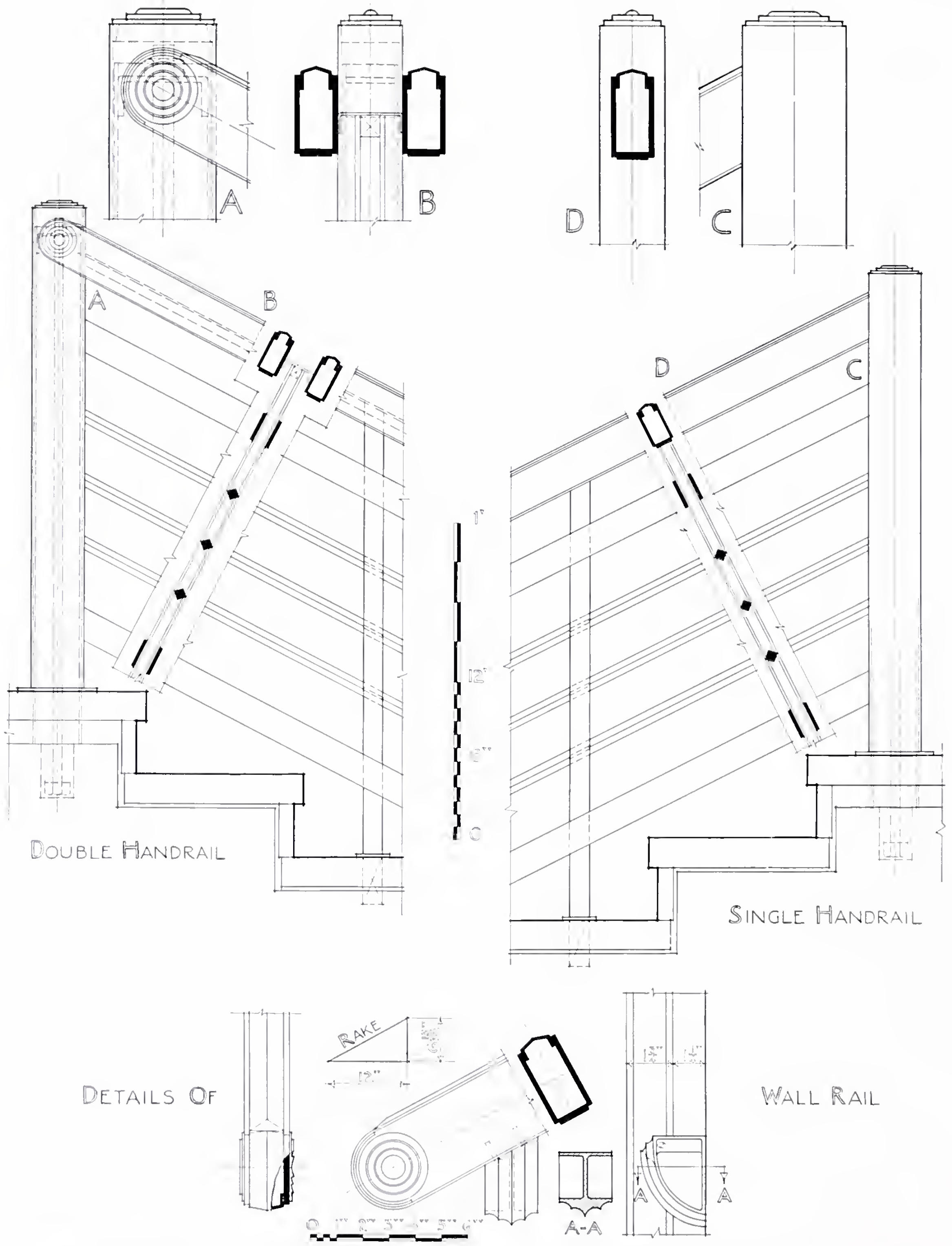


Fig. 48
Fireplace screen, andirons, and mantel of Monel Metal with marble trim. Designed by Buchman & Kahn, Architects.



HANDRAIL DETAILS T. EATON CO. LTD.

TORONTO ONTARIO CANADA

ROSS & MACDONALD ARCHITECTS SPROATT & ROLPH ASSOCIATES

PARKHURST '30

Fig. 49

Applications of MONEL METAL

THERE is no apparent limit to the adaptability of Monel Metal to architectural purposes. Its use is indicated wherever any one or more of its many qualifications are needed. It may be chosen solely for its color or for its hardness, resistance to wear or structural strength. It may be employed because it is one of the easiest decorative metals to keep clean and in its original condition. It may be used for permanency alone, even giving it finishes other than those developed in the natural metal.

In the pages immediately following will be found illustrations and brief text describing a wide variety of applications of Monel Metal in architectural work. Many others may be suggested by the designer's own ingenuity. In every instance, the indicated use of Monel Metal has already proved satisfactory through actual service under a wide variety of conditions.

It will be noted that the following illustrations do not emphasize the use of Monel Metal for exterior architectural details which are not placed where they can receive periodic cleaning. The International Nickel Company desires to advocate the use of Monel Metal only in places where its performance will prove fully satisfactory. They recognize that no metal in exterior applications will forever remain undimmed in its brilliance or color without a certain amount of attention. They would very much prefer to forestall disappointment in the performance of their product by discouraging its use in places where it cannot receive proper care, than to extend its markets by unconsidered enthusiasm for its many good properties. Only by strict adherence to this policy can the architects' interests be protected and the integrity of the product be maintained.

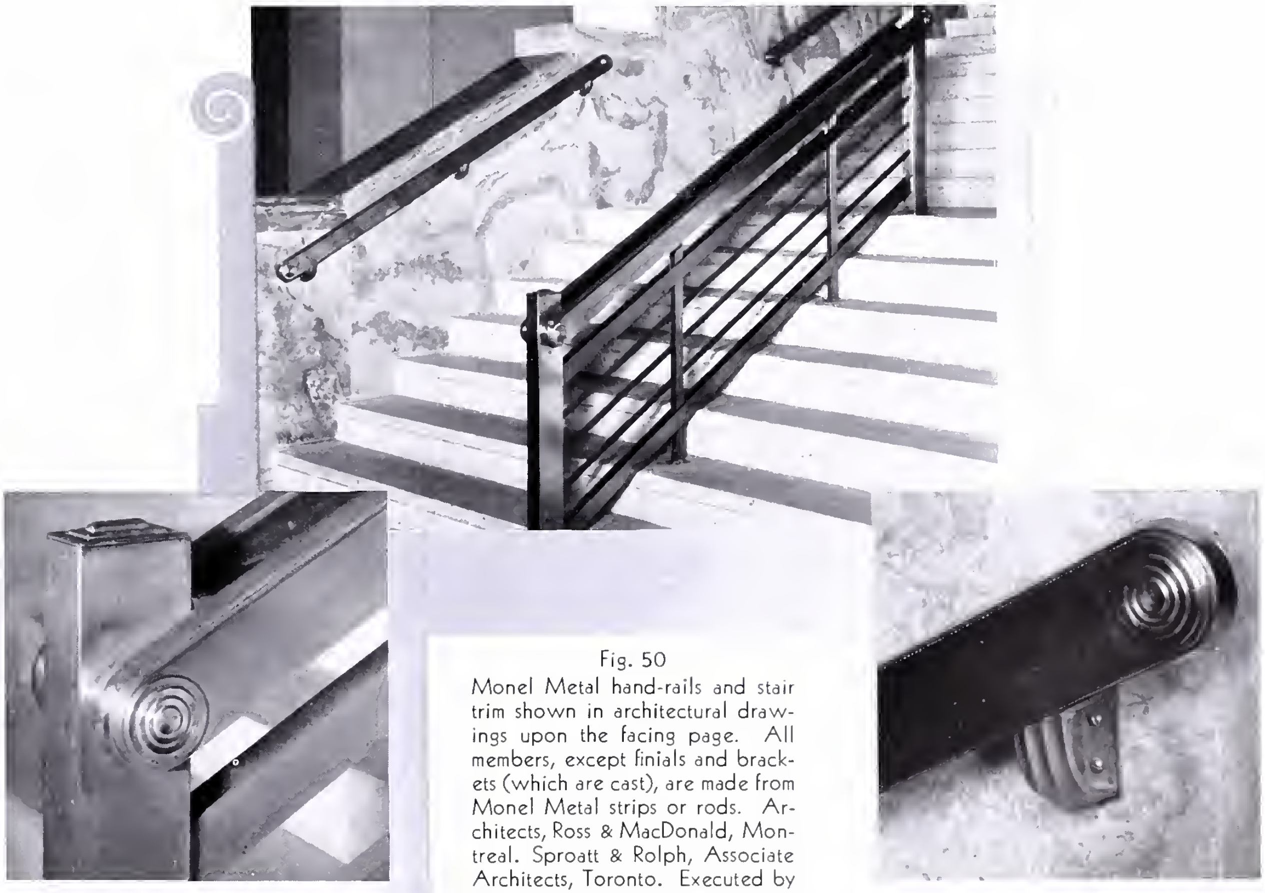


Fig. 50
Monel Metal hand-rails and stair trim shown in architectural drawings upon the facing page. All members, except finials and brackets (which are cast), are made from Monel Metal strips or rods. Architects, Ross & MacDonald, Montreal. Sproatt & Rolph, Associate Architects, Toronto. Executed by Architectural Bronze & Iron Works, Toronto.

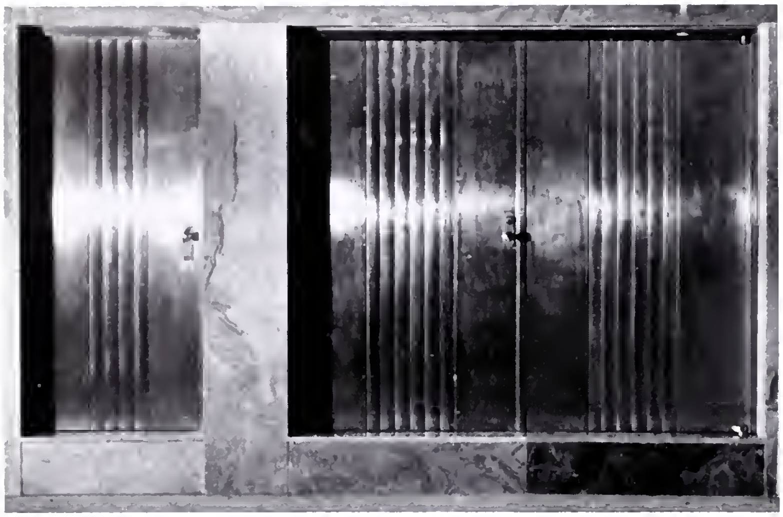
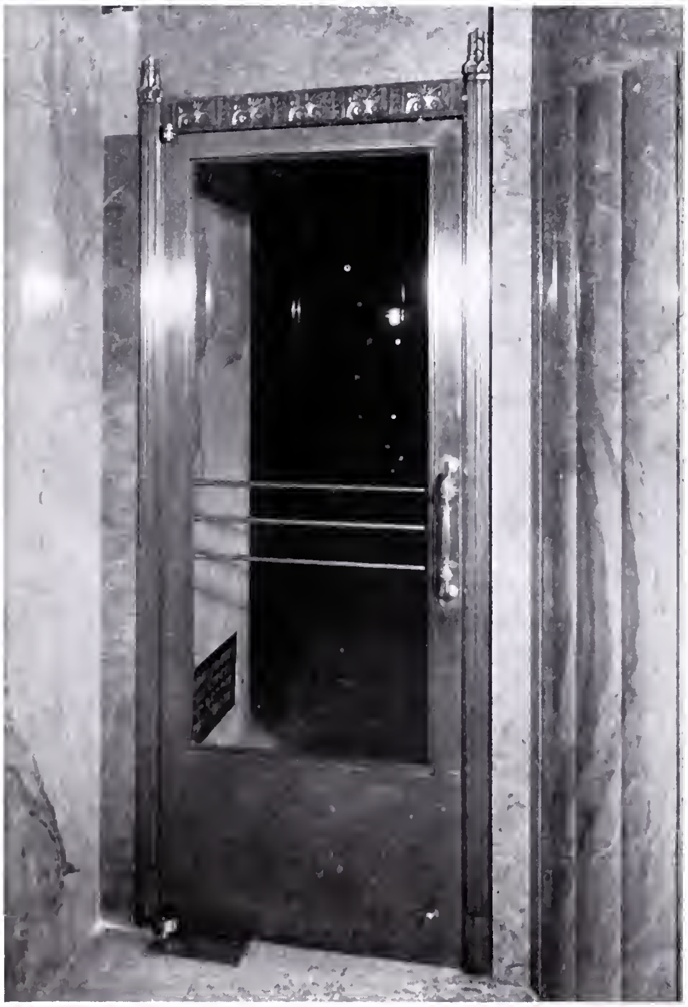


Fig. 51
Doors to service closets and show windows in the T. Eaton Company store, Toronto. Architects, Ross & MacDonald, Montreal. Sproatt & Rolph, Associate Architects, Toronto. Executed by Architectural Bronze & Iron Works, Toronto.

DOORS OF

NO architectural detail in a modern commercial building, hotel or apartment is of greater importance to the architect than the design and construction of doors and door frames. Constituting important elements in the decorative scheme and subject to constant use and frequently to severe abuse, these members combine utility and decorative value to an extraordinary degree.

Monel Metal possesses three distinct advantages for the construction of entrance and interior doors. First of these is its great structural strength; for Monel Metal has the rigidity and durability of steel or wrought iron.



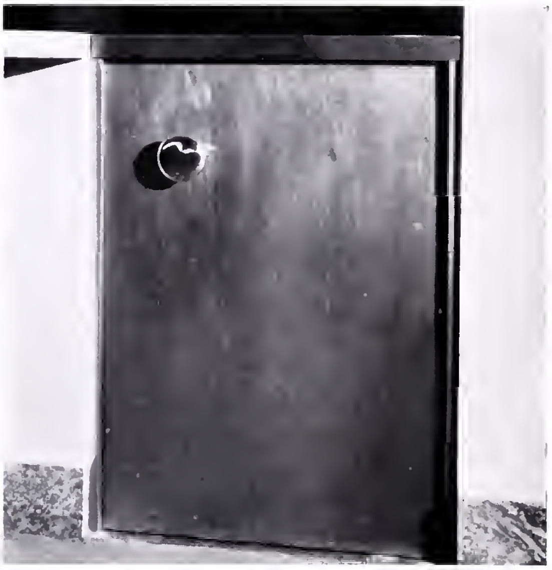


Fig. 52
Counter gate made of a single sheet of Monel Metal reinforced at the back.

Fig. 53
Monel Metal door with cast and drawn trim. Construction details are shown in Fig. 41 on Page 30. Architects, Ross & MacDonald Montreal. Sproatt & Rolph, Associate Architects, Toronto. Executed by Architectural Bronze & Iron Works, Toronto.

MONEL METAL

The second advantage lies in the resistance of Monel Metal to wear. Being solid throughout, there is no surface finish to chip or wear off. Its finishes are durable, resisting abrasion and constant contact. Its hardness and toughness prevents denting, scratching and injury through abusive handling. The metal does not stain, and the finger marks that always appear around handles or push plates can be wiped away without effort.

The third merit of Monel Metal is its inherent decorative value and the ease with which it may be formed to create unusual effects as illustrated here.

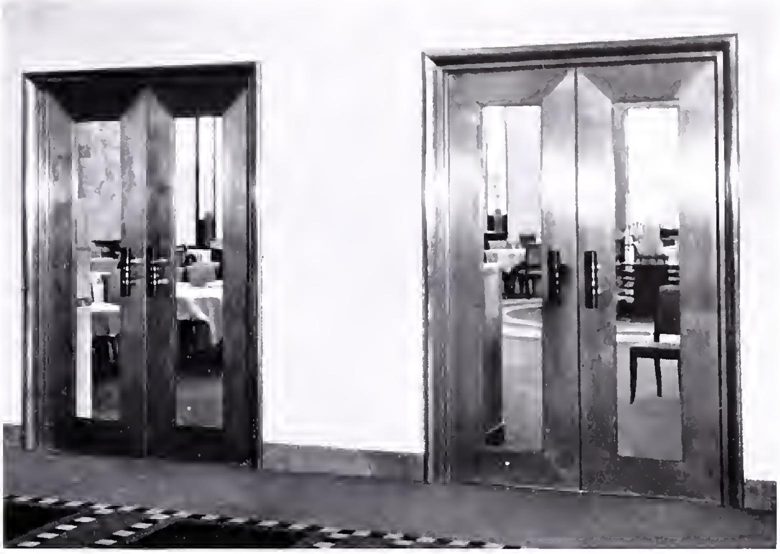


Fig. 54
Entrance doors of unusually simple and vigorous design leading to a modern restaurant. Architects, Ross & MacDonald, Montreal, Sproatt & Rolph, Associate Architects, Toronto. Executed by Architectural Bronze & Iron Works, Toronto.

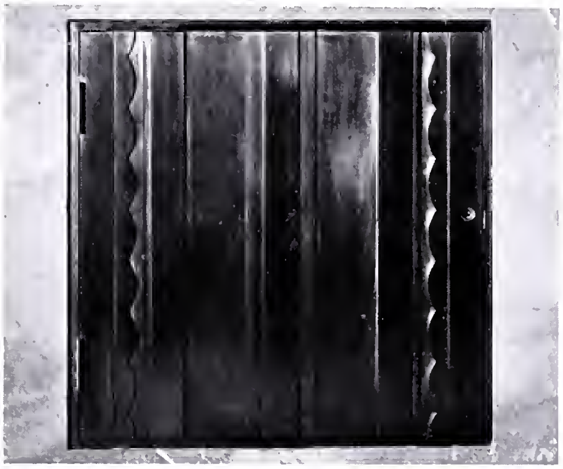


Fig. 55
Door to switch cabinet made of sheet Monel Metal with applied strips. Architects, Ross & MacDonald, Montreal. Sproatt & Rolph, Associate Architects, Toronto. Executed by Architectural Bronze & Iron Works, Toronto.

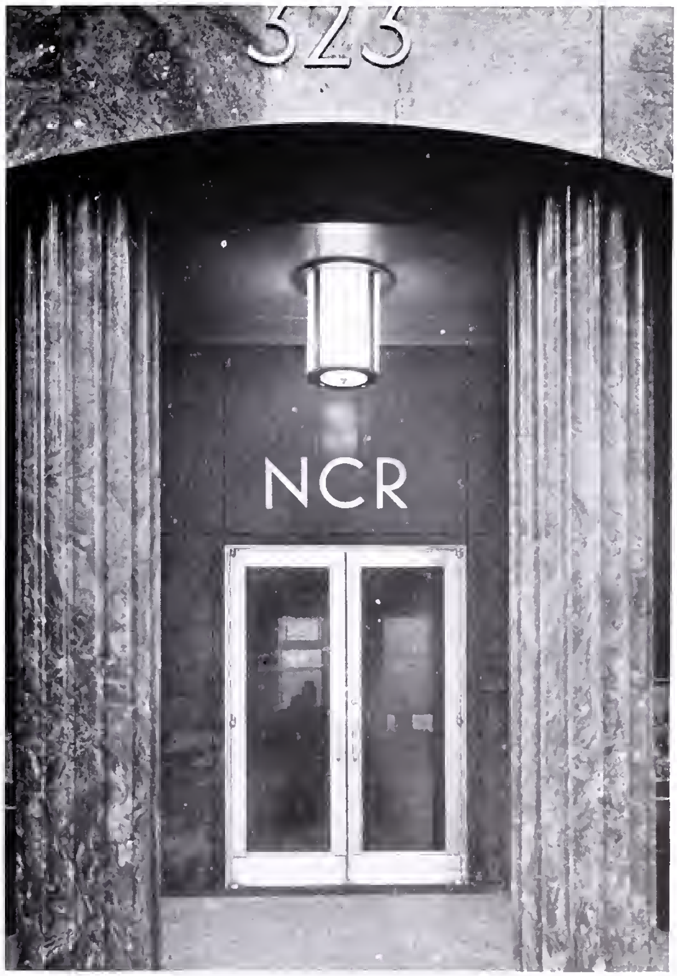
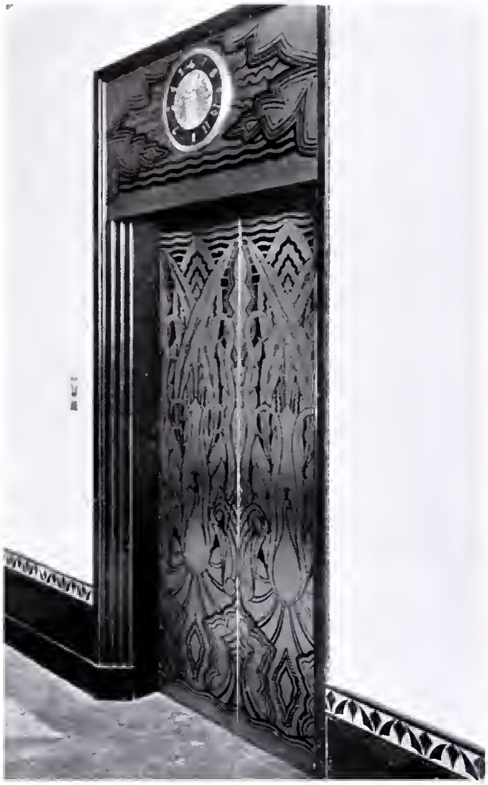


Fig. 56
Entrance to National Cash Register Company store, Chicago, showing Monel Metal doors. Designed by Holabird & Root, Architects. Executed by the Gorham Co., Providence, R. I.



ELEVATOR DOORS

SINCE elevator doors constitute the gateways to the various floors in the building, they deserve architectural treatment commensurate with their importance. At the same time, they must be sturdy, fire-resistive and easily maintained in their new appearance. Monel Metal construction is excellently adapted to such uses, possessing these desirable features to an unusual degree. The illustrations herewith suggest varied treatments of remarkable interest.

Fig. 57
Elevator doors and trim in Wilshire Tower Building, Los Angeles. Executed in etched Monel Metal with black enamel background, by Dahlstrom Metallic Door Co., Los Angeles.

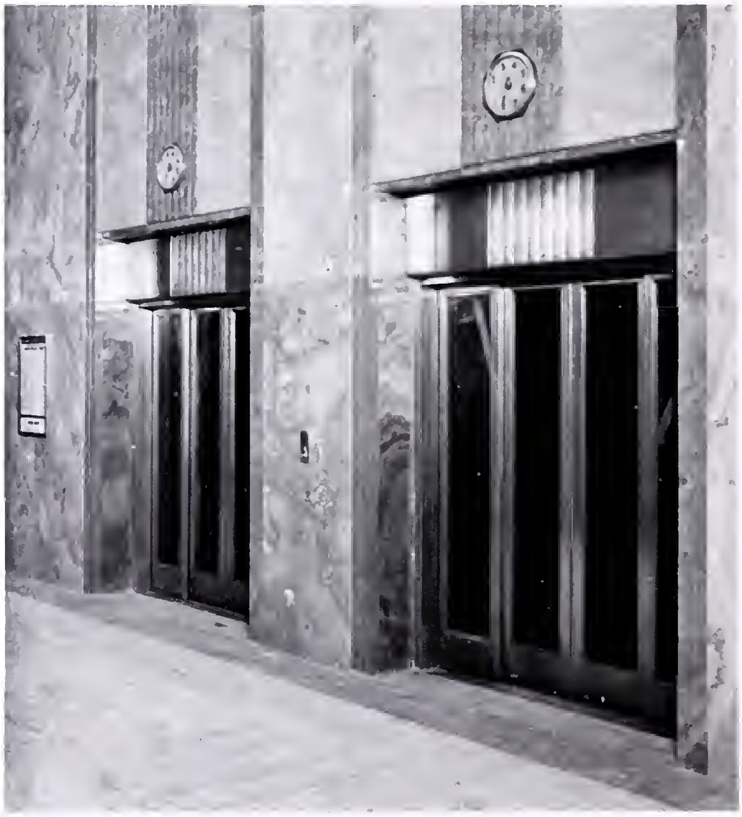


Fig. 58
Elevator arcade in the T. Eaton Company store, Toronto, showing bank of elevator doors similar in construction to those detailed in Figs. 43 and 44 on Pages 32 and 33. Architects, Ross & MacDonald, Montreal. Sproatt & Rolph, Associate Architects, Toronto. Executed by Architectural Bronze & Iron Works, Toronto.

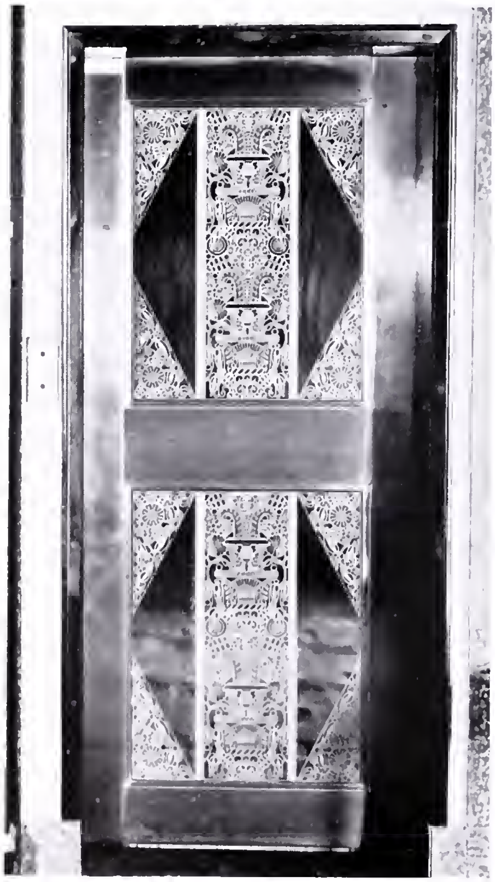


Fig. 59
Elevator door in the William Len Hotel, Memphis, Tenn. Eugene J. Stern, Architect. Etched Monel Metal panels contrasted with mirror polish. Frame and trim are steel with dead black finish. Executed by the Thorp Fireproof Door Co., Minneapolis, Minn.

REVOLVING DOORS

IN the design of revolving doors, sturdy construction must be combined with lightness, because the individual leaves must be relatively thin and the door should have minimum weight. Furthermore, building codes inevitably require large glass panels for clear visibility, placing a further responsibility upon the metal framework. Here again the strength and rigidity of Monel Metal, combined with its resistance to wear and abuses, make it of exceptional value for revolving doors.

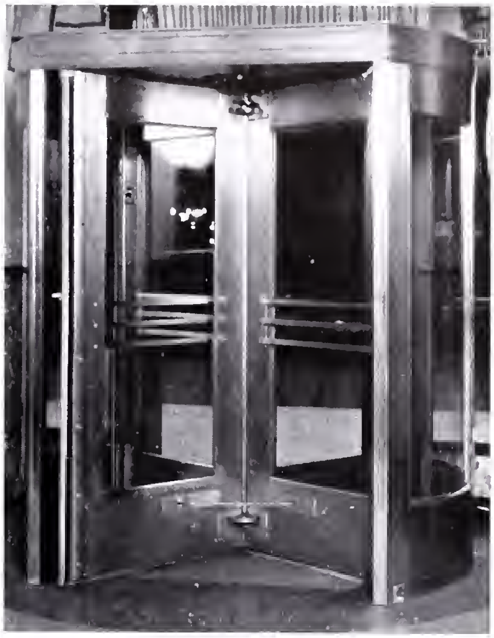


Fig. 60
Revolving doors of all-Monel Metal construction in Western Union Office, Board of Trade Building, Chicago. Holabird & Root, Architects. Executed by Van Kannel Revolving Door Co., New York.

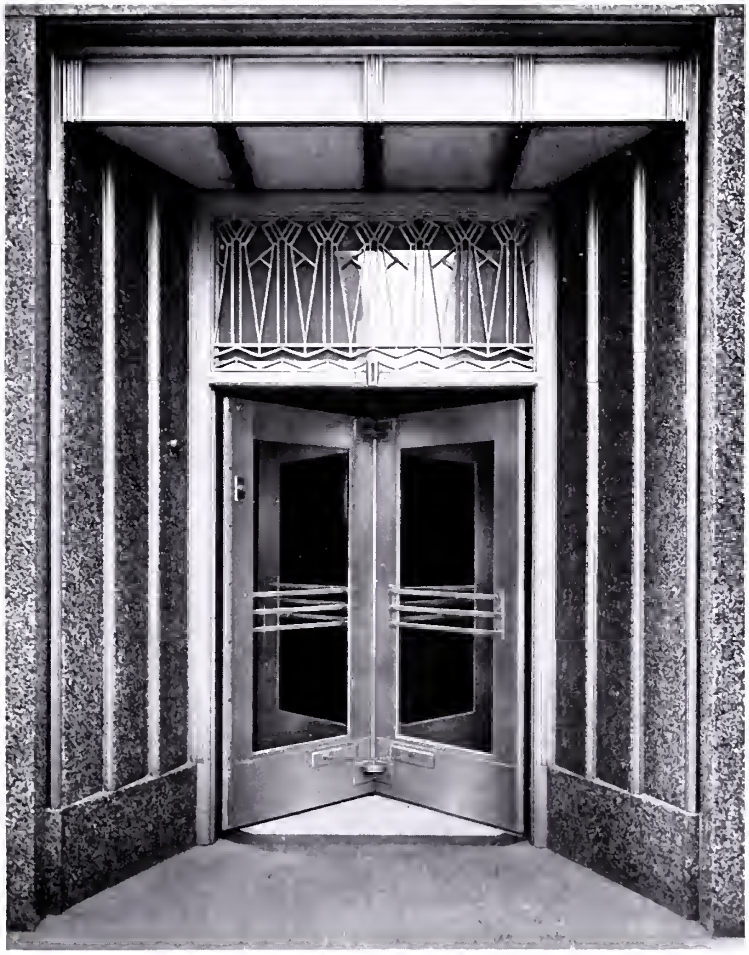


Fig. 61
Monel Metal revolving doors and decorative trim in entrance of the Board of Trade Building, Chicago, Holabird & Root, Architects. Executed by Van Kannel Revolving Door Co. New York.

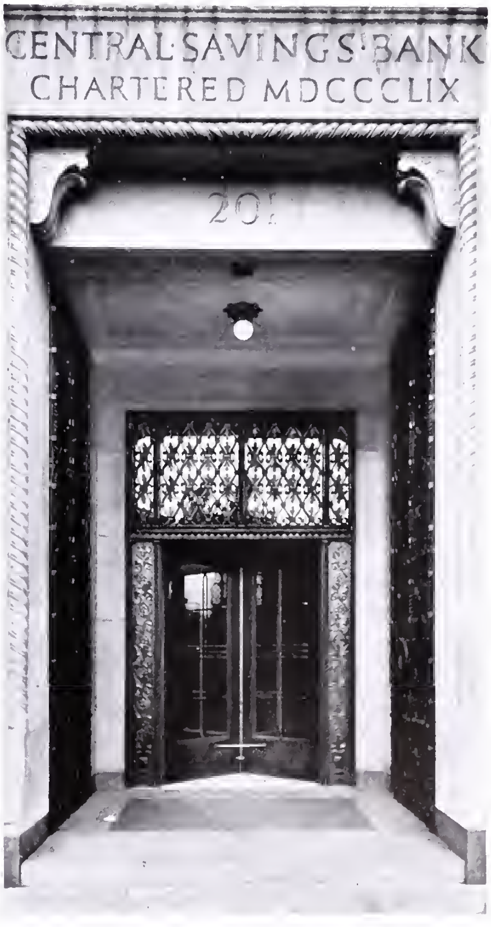


Fig. 62
Revolving doors of all Monel Metal construction in the Central Savings Bank, New York City. Executed by Van Kannel Revolving Door Co., New York.

MONEL METAL HAS MANY USES IN

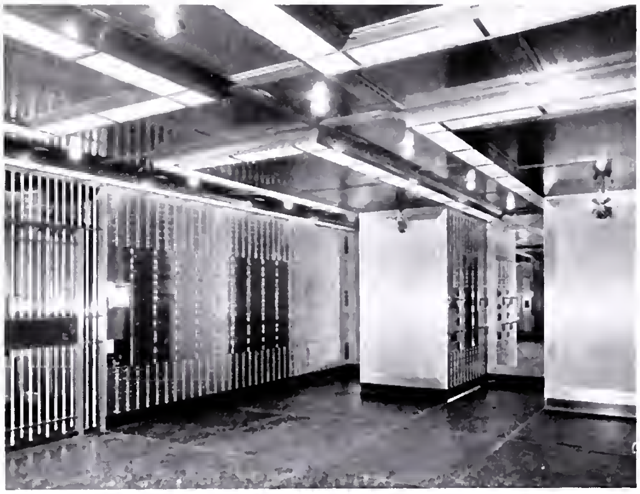
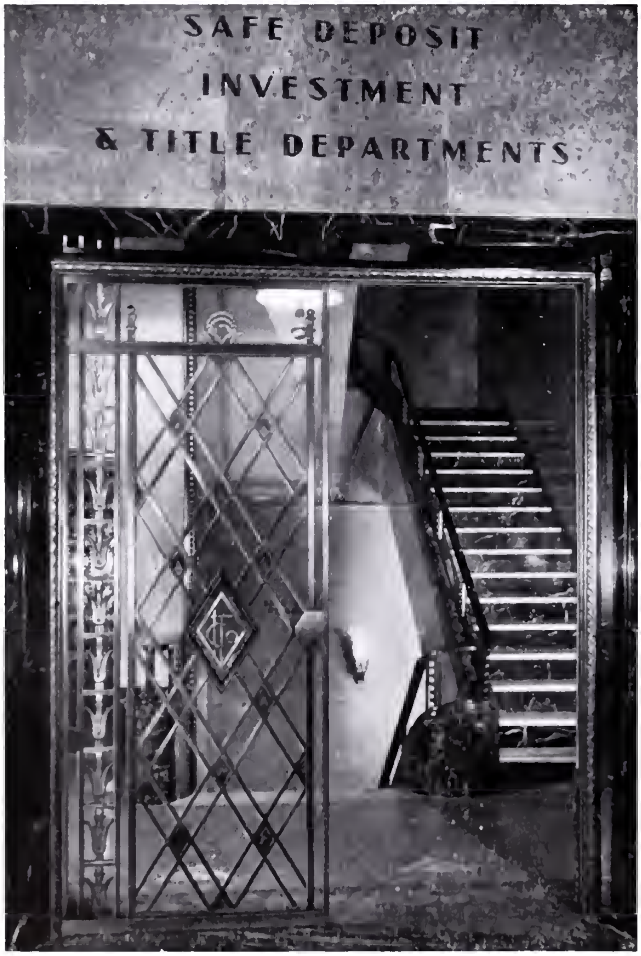


Fig. 63
Safe deposit vaults in the Canadian Bank of Commerce, Toronto. Darling & Pearson, Architects, Toronto. E. F. Abell, Vault Engineer, New York. All Monel Metal construction throughout. Executed by The Goldie & McCullough Co. Ltd., Galt, Ontario, Canada, and J. & J. Taylor, Ltd. Toronto

THERE is a great deal of symbolism involved in the architectural design of banking quarters. The monumental character given to the public space of almost every bank is intended to reflect permanency, dignity, stability and wealth. Similarly, the choice of metalwork may very properly connote security in addition to these other qualities. For this purpose, Monel Metal represents an ideal material. Even to the uninitiated who know little of its actual physical properties, Monel Metal looks and feels its inherent strength. Its brilliant whiteness, crisp lines and solid construction tell a true story of security and safety. Coupled with these characteristics is unusual decorative value consistent with the quality of treatment which is uniformly accorded to banking rooms.

The illustrations on this page suggest but a few of the applications of Monel Metal in banking



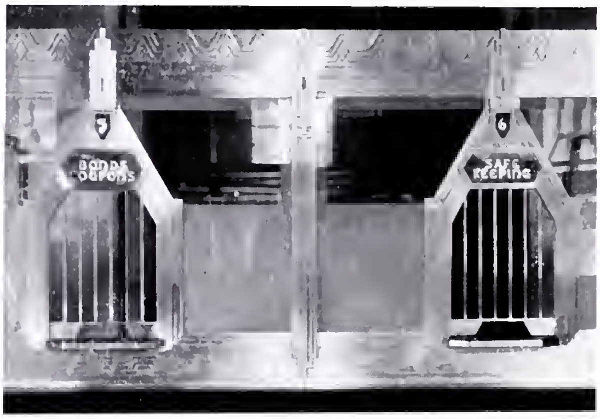


Fig. 64
Section of counter of main banking room, Union Trust Company, Detroit. Fabrication methods illustrated in Figs. 16, 21 and 22. Designed by Smith, Hinchman & Grylls, Architects, Detroit. Executed by The Gorham Co., Providence, R. I.

Fig. 65
Gates at entrance to safe deposit vaults, Integrity Trust Company, Philadelphia, showing Monel Metal in combination with bronze. Paul Philippe Cret, Architect. Executed by the Wm. H. Jackson Co., Brooklyn, New York.

BANKING QUARTERS OF ALL TYPES

quarters. It has been employed for doors, grilles, gates, counter screens, check desks, windows, stair railings, vault interiors and safe deposit boxes—in fact for every metal detail from name plates to lighting fixtures and waste-baskets.

Attention is particularly called to the advantage of using Monel Metal as a foil or focal point in designs that involve colorful treatment in rich marbles, inlaid woods, mosaic floors and ornamented ceilings. This application is well expressed in the banking room of the Union Trust Company in which brilliant coloring has been harmonized by the constant use of Monel Metal for check desks, counter screens, doors, grilles and gates. Note also the all-Monel Metal safe deposit vaults in the Canadian Bank of Commerce Building at Toronto in which walls and ceilings as well as box lockers and grilles are made exclusively of this metal.

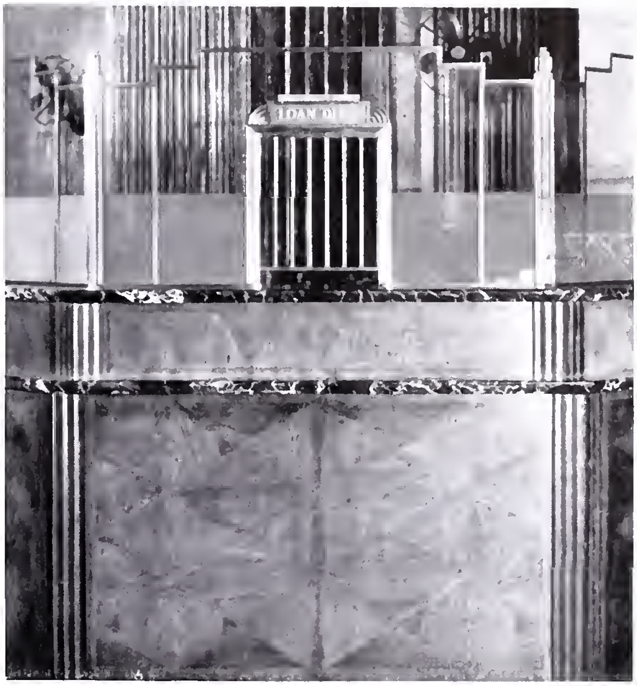
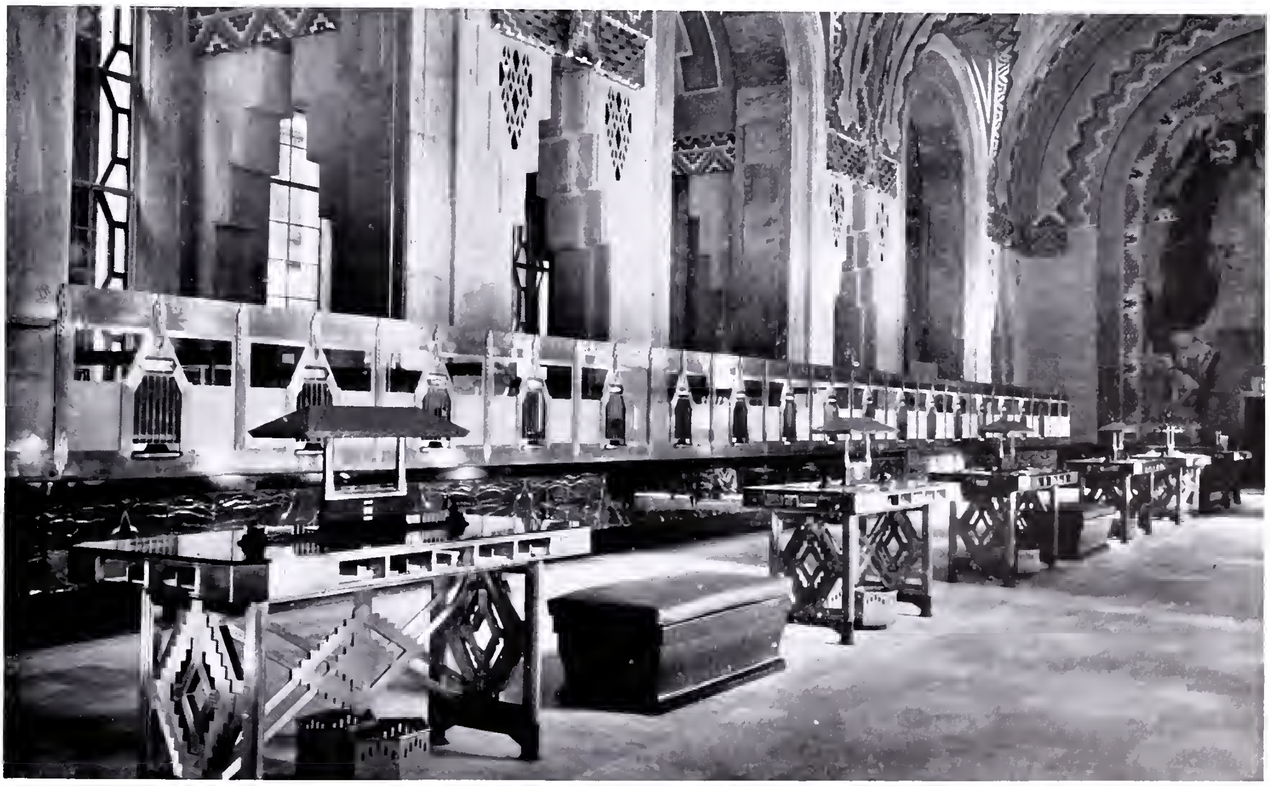


Fig. 67

Screen supports of oxidized bronze with Monel Metal trim in Broadway National Bank & Trust Company, New York. Designed by Louis H. Friedland, Architect, New York. Executed by Superb Bronze & Iron Co., Brooklyn, N. Y.

Fig. 66

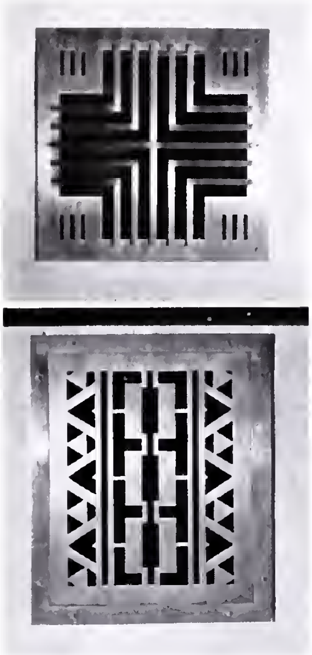
Main banking room, Union Trust Company, Detroit, showing Monel Metal check desks, counter screens, waste-baskets. Designed by Smith, Hinchman & Grylls, Architects, Detroit. Executed by The Gorham Co., Providence, R. I.



GRILLES, RAILINGS AND

THE illustrations on this page speak eloquently of the versatility of Monel Metal for the development of grilles, railings, gates and crestings of all types. In these applications, the strength and rigidity of Monel Metal lends integrity to the design, for there is no need for employing baser metals concealed behind the decorative elements to secure requisite strength.

As noted elsewhere, Monel Metal may be forged to create patterns, which in earlier periods could be developed only in wrought iron, with a resulting brilliance and crispness to the work which exceeds the beauty of the inferior metal. Wrought iron finishes can be obtained from Monel Metal by leaving in



Figs. 68 and 69
A pair of ventilating grilles made of pierced Monel Metal plate; the upper one showing also applied rods.

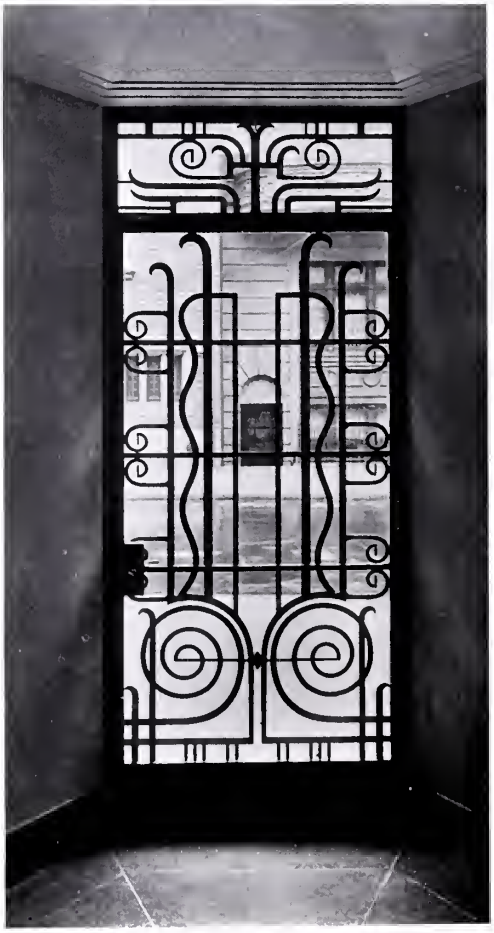
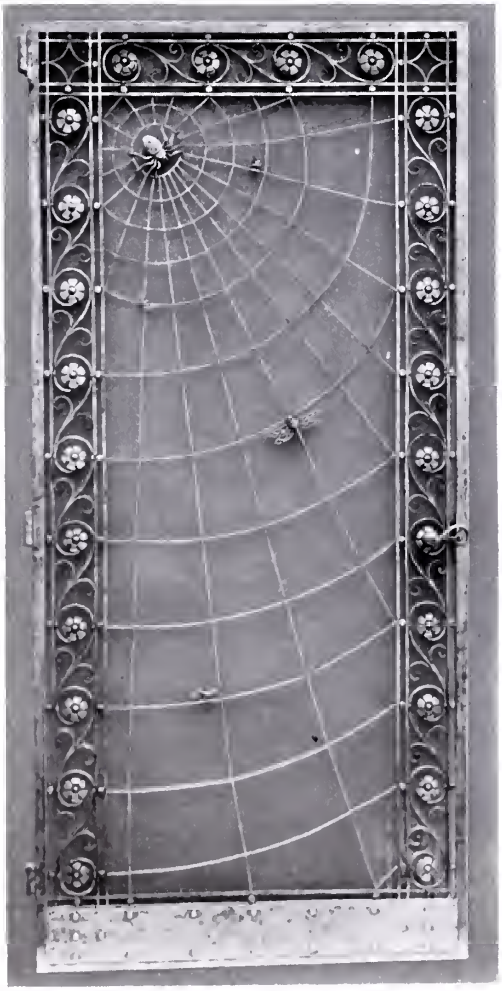


Fig. 72
Forged Monel Metal door at 49 East 80th Street, New York. Designed by Harry Allen Jacobs, Architect. See also Fig. 31 on Page 24. Executed by Renner & Maras, Inc., Long Island City, New York.



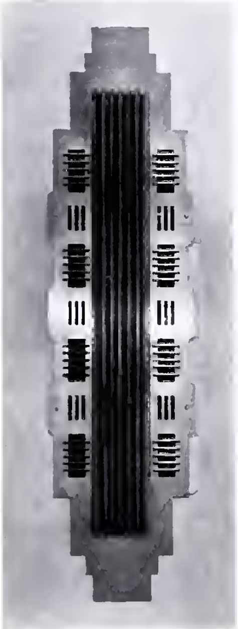


Fig. 70
A combined grille and lighting fixture developed in Monel Metal plates and glass.

Fig. 71
An extraordinarily graceful spider-web door of hand forged Monel Metal. Designed by H. T. Lindeberg, architect. Executed by the Iron Craftsmen Philadelphia, Pa.

GATES OF MONEL METAL

place the durable black oxide that forms during the heating and forging process, or a polished or semi-polished effect can be produced with equal ease by partially or wholly removing this oxide.

For more modernistic treatments, the use of rods, plates, strips and sheet Monel Metal, or the development of cast details give to the designer utmost leeway in the creation of forms that express the newer note in architecture.

In whatever form it may be developed, Monel Metal is a material worthy of the skill of the finest designers and the best craftsmen.

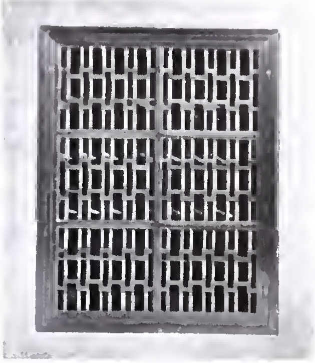


Fig. 73
Grille built up of rods, strips and cut plate work in the T. Eaton Company store at Toronto. Architects, Ross & MacDonald, Montreal. Sproatt & Rolph, Associate Architects, Toronto. Executed by Architectural Bronze & Iron Works, Toronto.

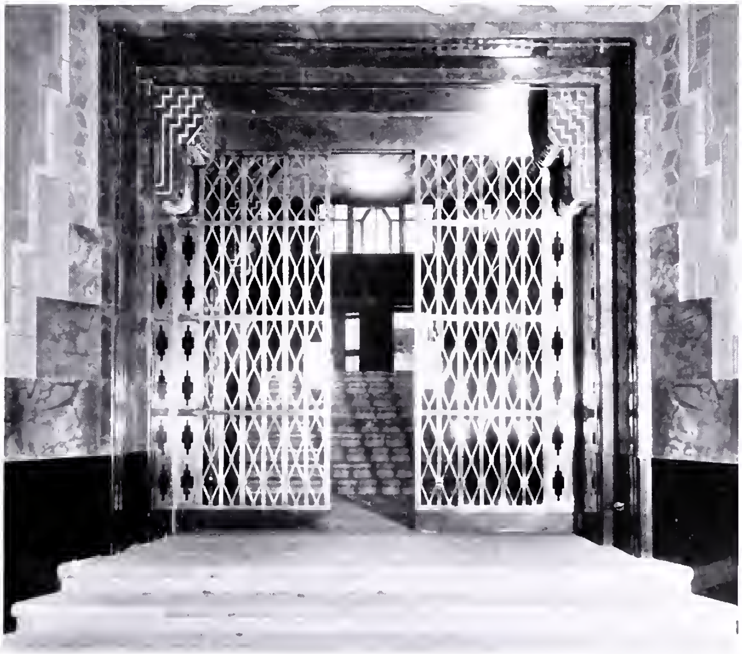


Fig. 74
Monel Metal gates leading to the lower banking room from a main lobby Union Trust Building, Detroit. Designed by Smith, Hinchman & Grylls, Architects, Detroit. Executed by The Gorham Co., Providence, R. I.

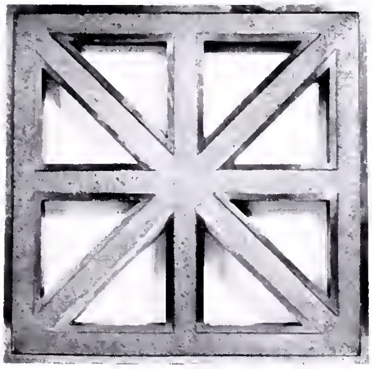


Fig. 75
Cast Monel Metal grille with stipple finished background and polished relief Executed by the Superb Bronze & Iron Co., Brooklyn, N. Y.

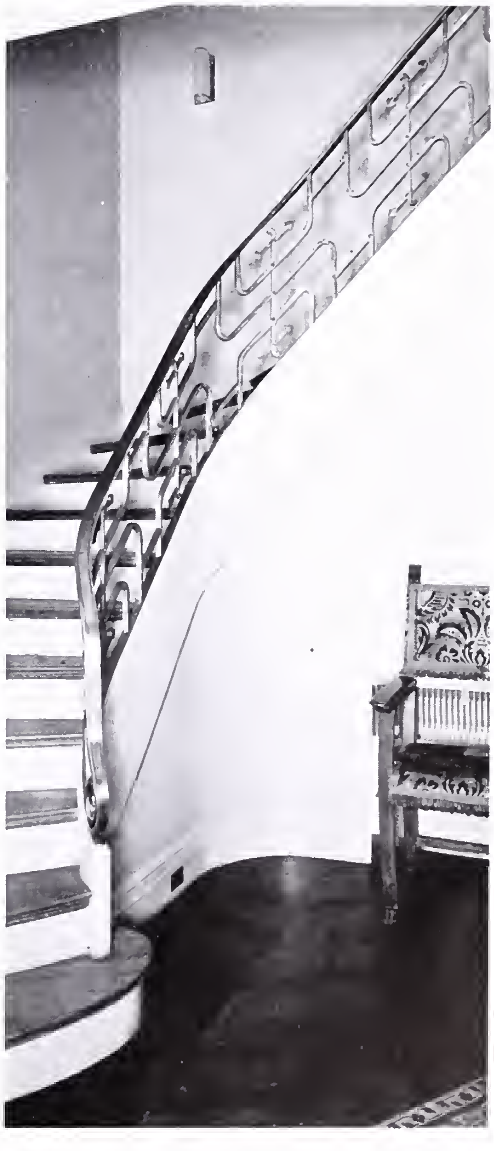


Fig. 76
Forged Monel Metal balustrade and railing in house at 49 East 80th Street, New York. See Fig. 72. Designed by Harry Allen Jacobs, Architect. Executed by Renner & Maras, Inc., Long Island City, N. Y.

ARCHITECTURAL DETAILS AND ACCESSORIES

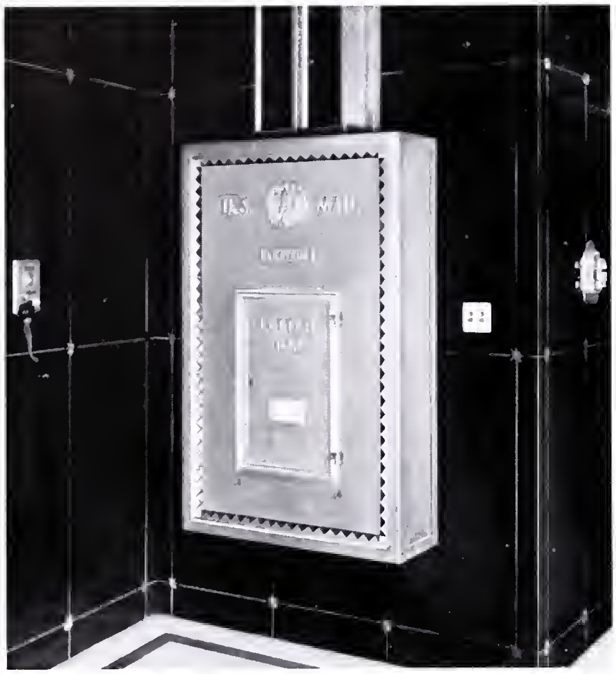
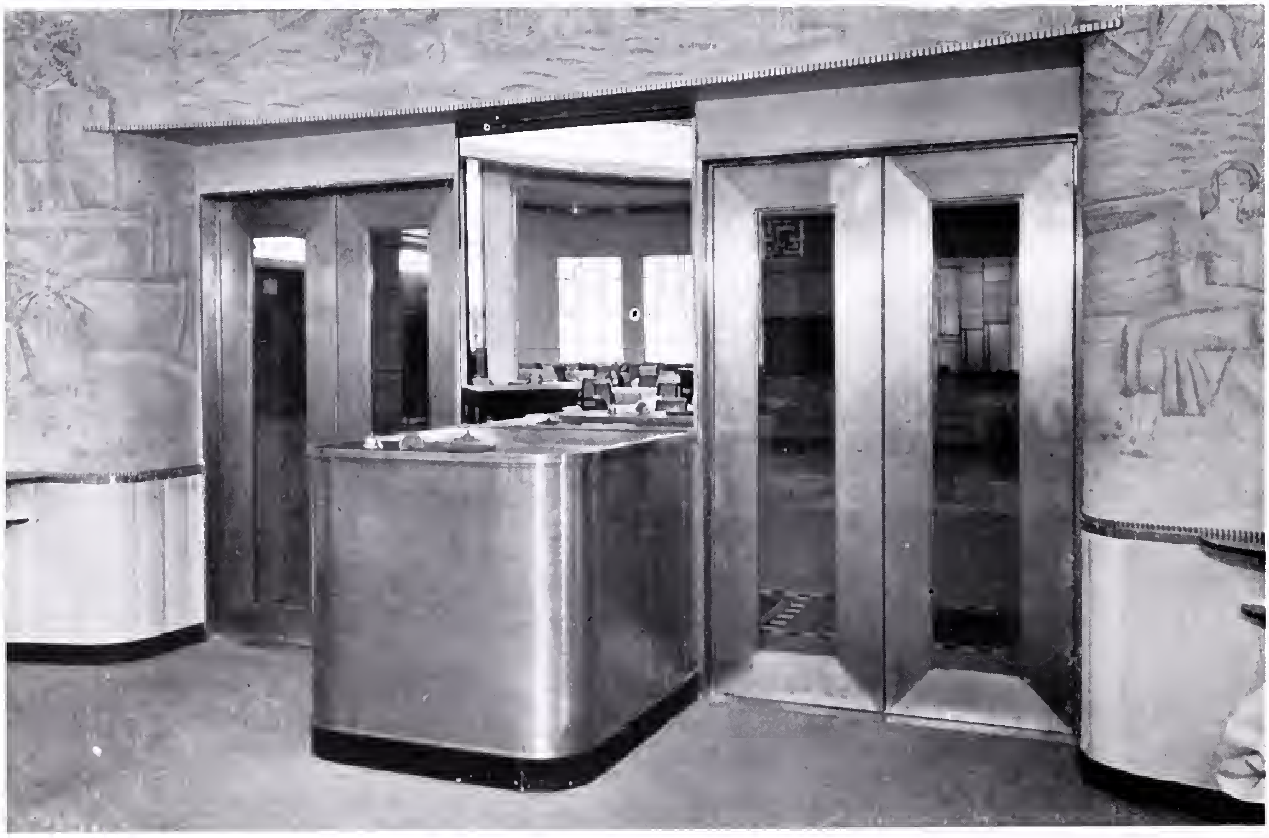


Fig. 77
Mail box of Monel Metal for the Wall & Hanover Building, New York. Executed by John Williams, Inc. Delano & Aldrich, Architects, New York.

SKYSCRAPER construction in our great urban centers has forced architects and building investors to realize that the man on the street largely measures the quality and beauty of a building more by the parts with which he comes in contact than by the lofty façades which he seldom sees. However, there has always been a keen appreciation of the need for establishing the character of a structure at its entrance and in its public areas. These considerations very naturally lead to a concentration of interest in the design of public lobbies, corridors, vestibules and reception rooms, whether in modern office buildings, hotels, apartments or monumental public structures. Here the richest materials are

Fig. 78
Cashier's desk and doors of Monel Metal at the entrance to the restaurant in the T. Eaton Company store, Toronto. Architects, Ross & MacDonald, Montreal. Sproatt & Rolph, Associate Architects, Toronto. Executed by Architectural Bronze & Iron Works, Toronto.



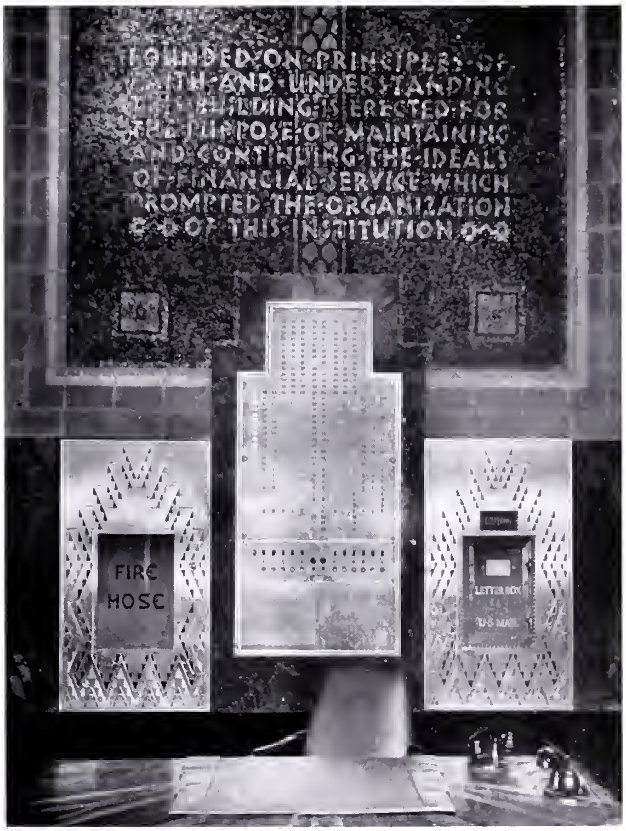
FOR LOBBIES AND OTHER PUBLIC SPACES

brought together and the designer is limited only by the skill of the craftsmen in creating rich effects. Naturally the tendency is to employ Monel Metal because of its uniformly recognized superiority as the finest of the decorative materials.

On other pages, we have illustrated doors, vestibules, elevator doors and many types of ornamental trim. Here are presented illustrations of typical accessories that complete the finishings of lobbies and other public areas. Elevator signal boards, building directories, mail boxes, information counters and minor metal accessories are illustrated to suggest some of the practical details which can be happily created in this enduring and brilliant material.

Fig. 79

Monel Metal hose cabinet, letter box and elevator indicator panel with inset Favrile glass in lobby of the Union Trust Building, Detroit. Designed by Smith, Hinchman & Grylls, Architects, Detroit. Executed by The Gorham Co., Providence, R. I.


FOUNDED ON PRINCIPLES OF FAITH AND UNDERSTANDING THIS BUILDING IS ERECTED FOR THE PURPOSE OF MAINTAINING AND CONTINUING THE IDEALS OF FINANCIAL SERVICE WHICH PROMPTED THE ORGANIZATION OF THIS INSTITUTION
FIRE HOSE
LETTER BOX
U.S. MAIL

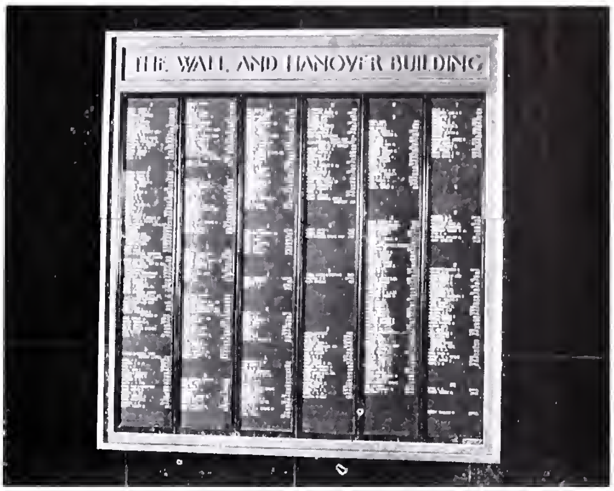
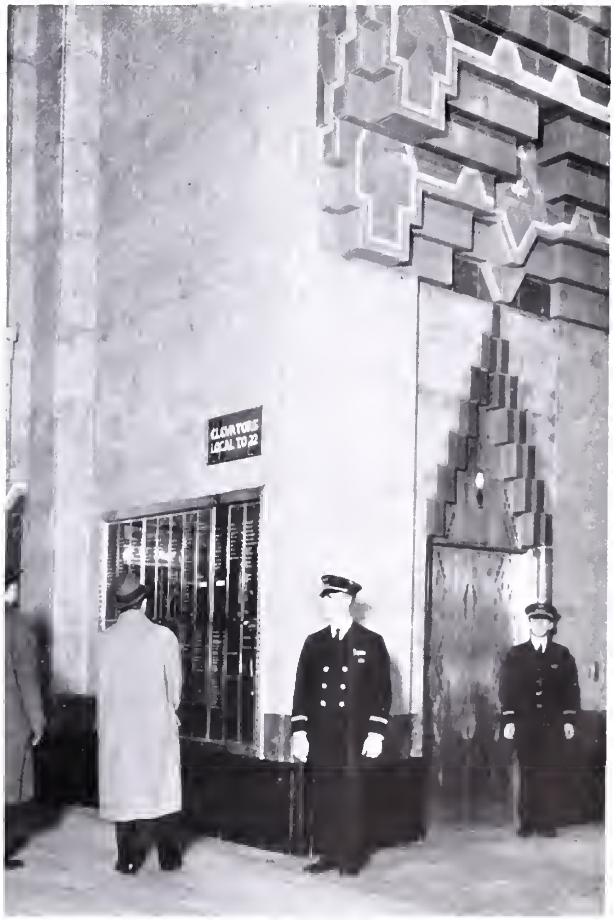


Fig. 80

Monel Metal directory board matching the mail box shown in Fig. 77 and the beautiful elevator doors shown in Fig. 6 on Page 12.

Fig. 81

A corner in the main lobby of the Union Trust Building showing various details developed in Monel Metal. Designed by Smith, Hinchman & Grylls, Architects, Detroit. Executed by The Gorham Co., Providence, R. I.



HARDWARE AND LIGHTING FIXTURES

NATURALLY the widespread use of Monel Metal for decorative purposes has fostered the development of many accessory details in this material. Manufacturers of lighting fixtures have long employed Monel Metal for its inherent beauty, ease of fabrication and adaptability to repoussé work, forging and the crisp reproduction of wrought iron details.

A few manufacturers of hardware have already introduced standard finish hardware in Monel Metal and 20% Nickel-Silver. The latter material is somewhat easier to cast in commercial forms and matches

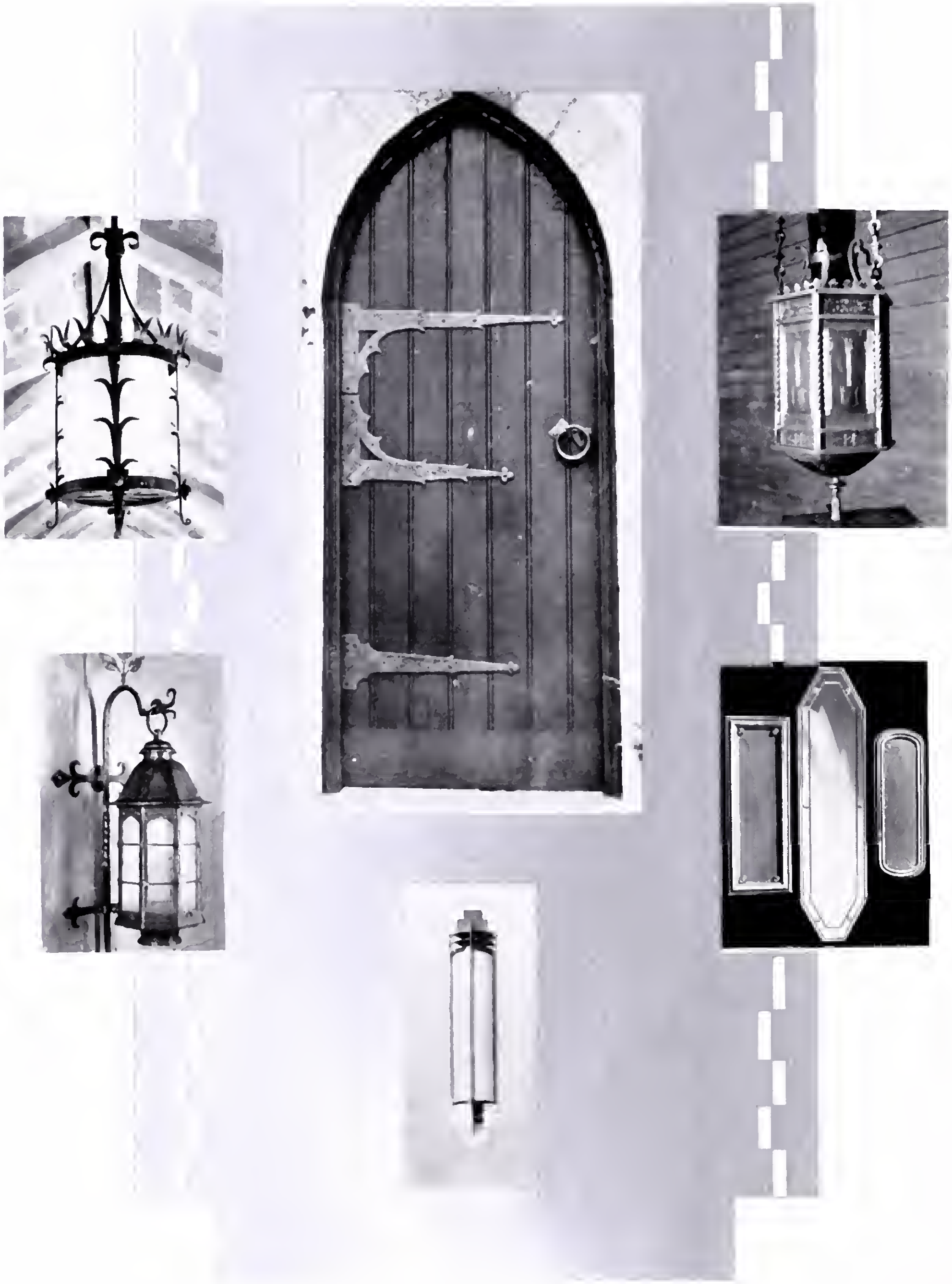


Fig. 82

EFFECTIVELY DEVELOPED IN MONEL METAL

Monel Metal so closely as to warrant its general acceptance for such purposes.

Even furniture of modernistic pattern is commercially available, combining Monel Metal with choice woods and fabrics. Thus the architect and decorator, having created the architectural motif in this superior white metal, can readily complete the scheme through the procurement or execution of accessories in matching color, texture and pattern. The selections on these pages suggest the possibilities in this direction. Names of commercial producers of such accessories will be supplied on request.

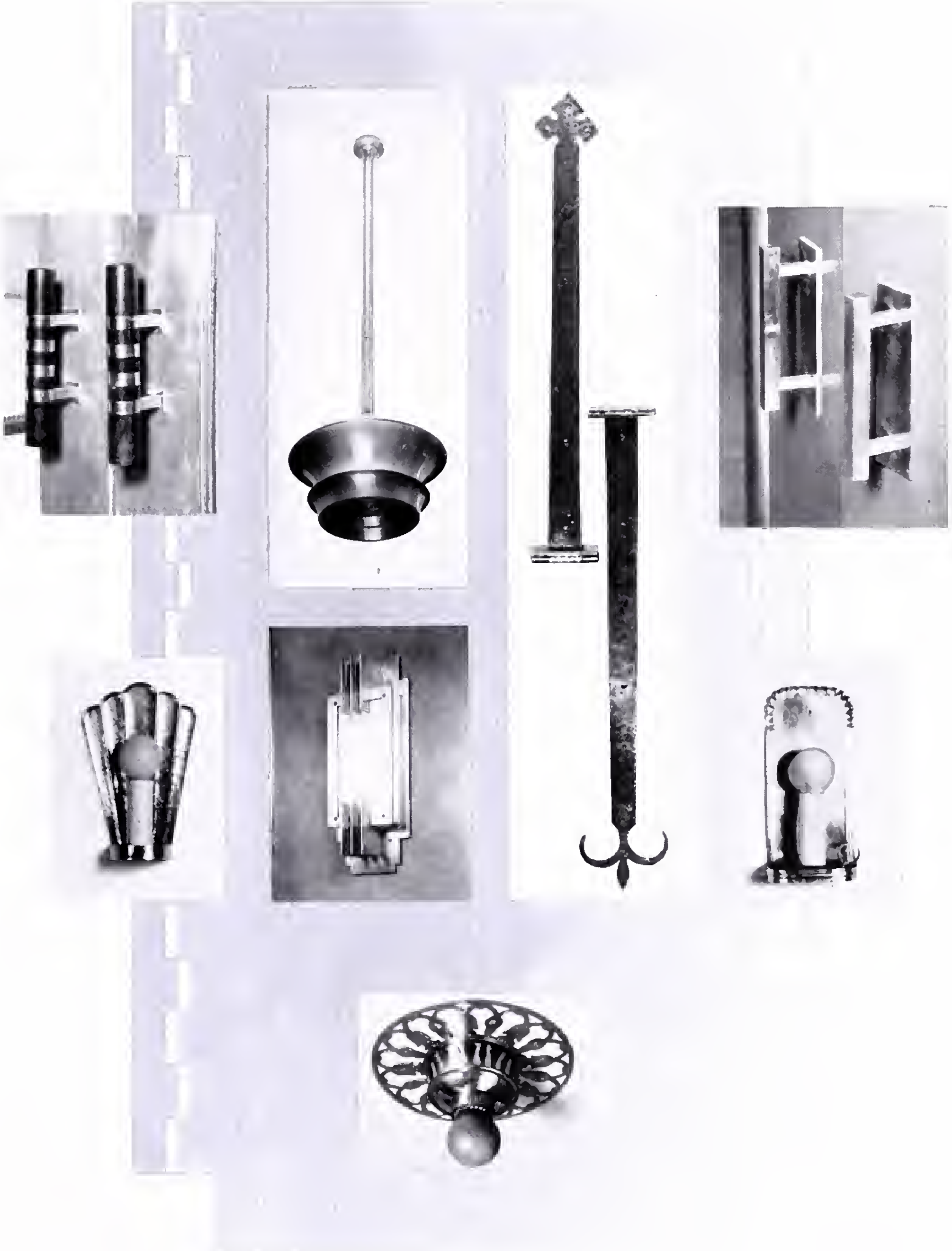


Fig. 83

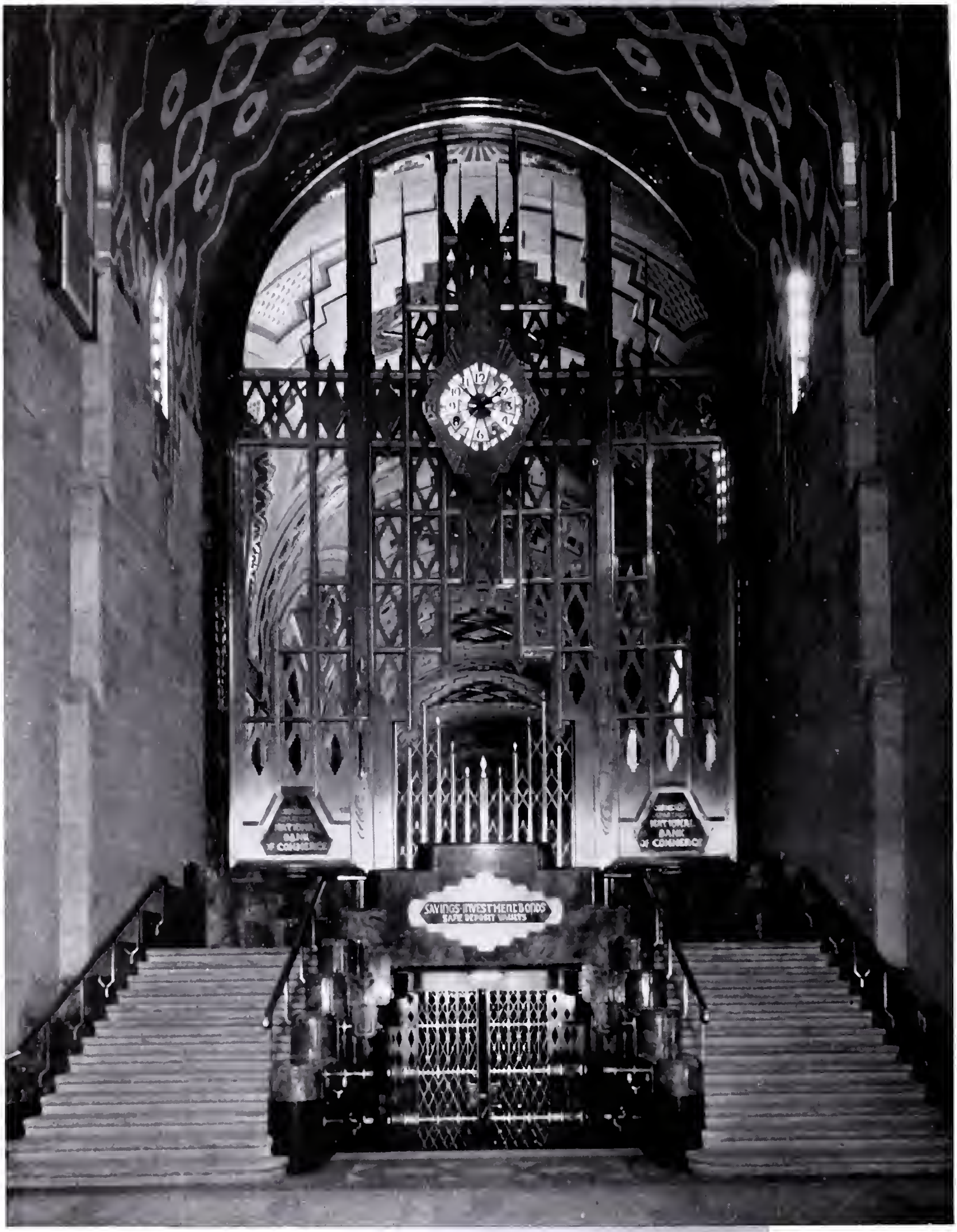


Fig. 84
The colorful interior of the main banking room, Union Trust Building, Detroit, is notable for its use of Monel Metal in modernistic forms of geometric character. Grille over entrance.

Notable Decorative Details Expressed in Monel Metal

UP to this point, consideration has been given chiefly to practical problems surrounding the use of decorative metalwork with especial reference to Monel Metal. In the following pages will be found a series of plates selected for their inspirational rather than their practical value. In each case the picture represents some notable structure or detail in which the architect or decorator has found Monel Metal the medium through which to establish the keynote of his design.

In these pages will be found varied architectural motifs some originating in earlier architectural periods; others reflecting the modern trend in European and American design. In several cases Monel Metal has been combined with other of the richer metals to give the metalwork its varied color, texture and form. In others Monel Metal is used with marbles, fine woods, glass, tile and polychrome plaster work.

Its adaptability to these varying problems is not only the result of inherent qualities of Monel Metal, but is the product of intelligent design and a keen appreciation of the individual personalities of metals and other decorative materials.

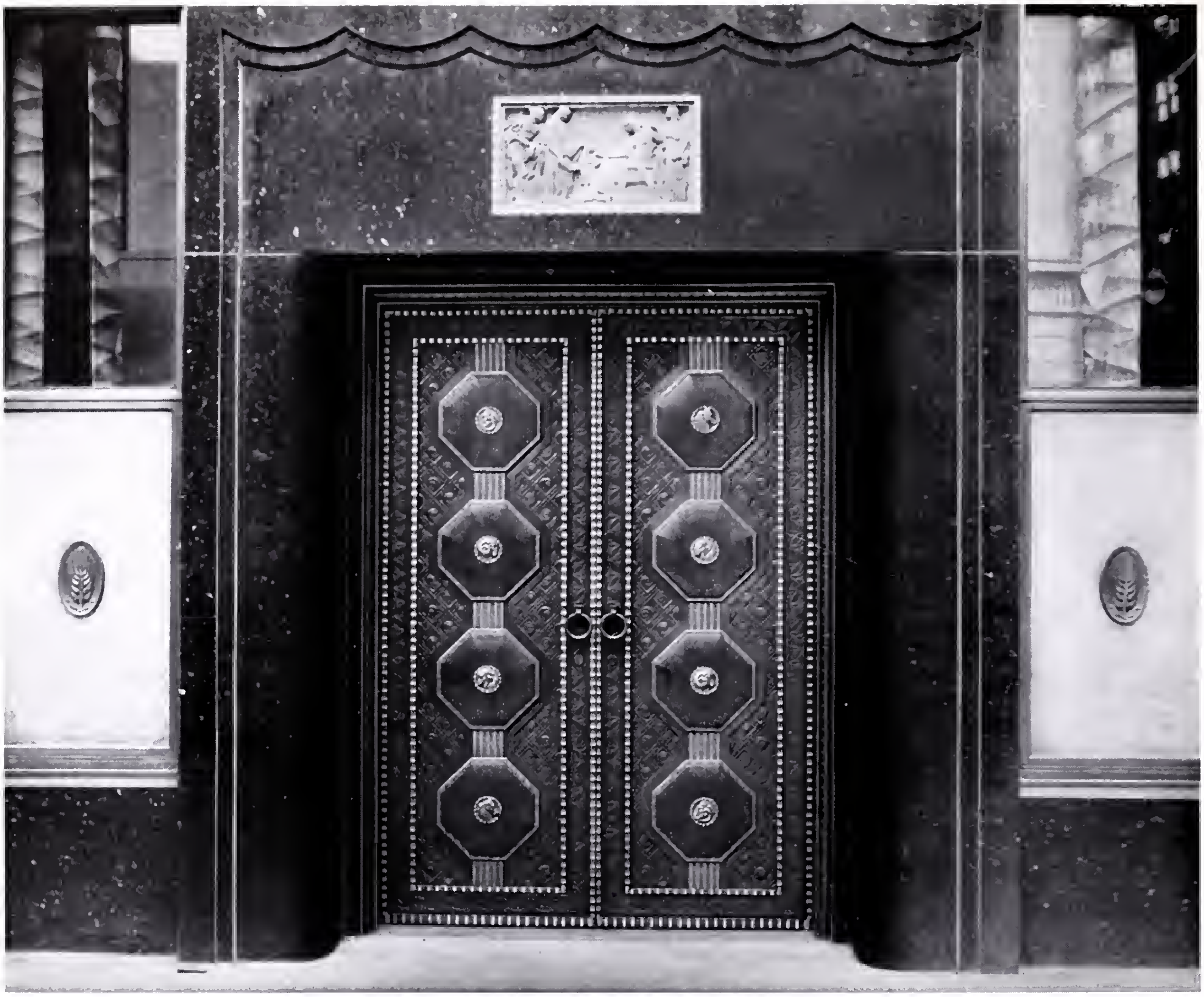


Fig. 85
Monel Metal and bronze entrance doors, Integrity Trust Company Building, Philadelphia, Pa. Designed by Paul Philippe Cret, Architect, Philadelphia, Pa. Executed by the William H. Jackson Company, Brooklyn, N. Y.

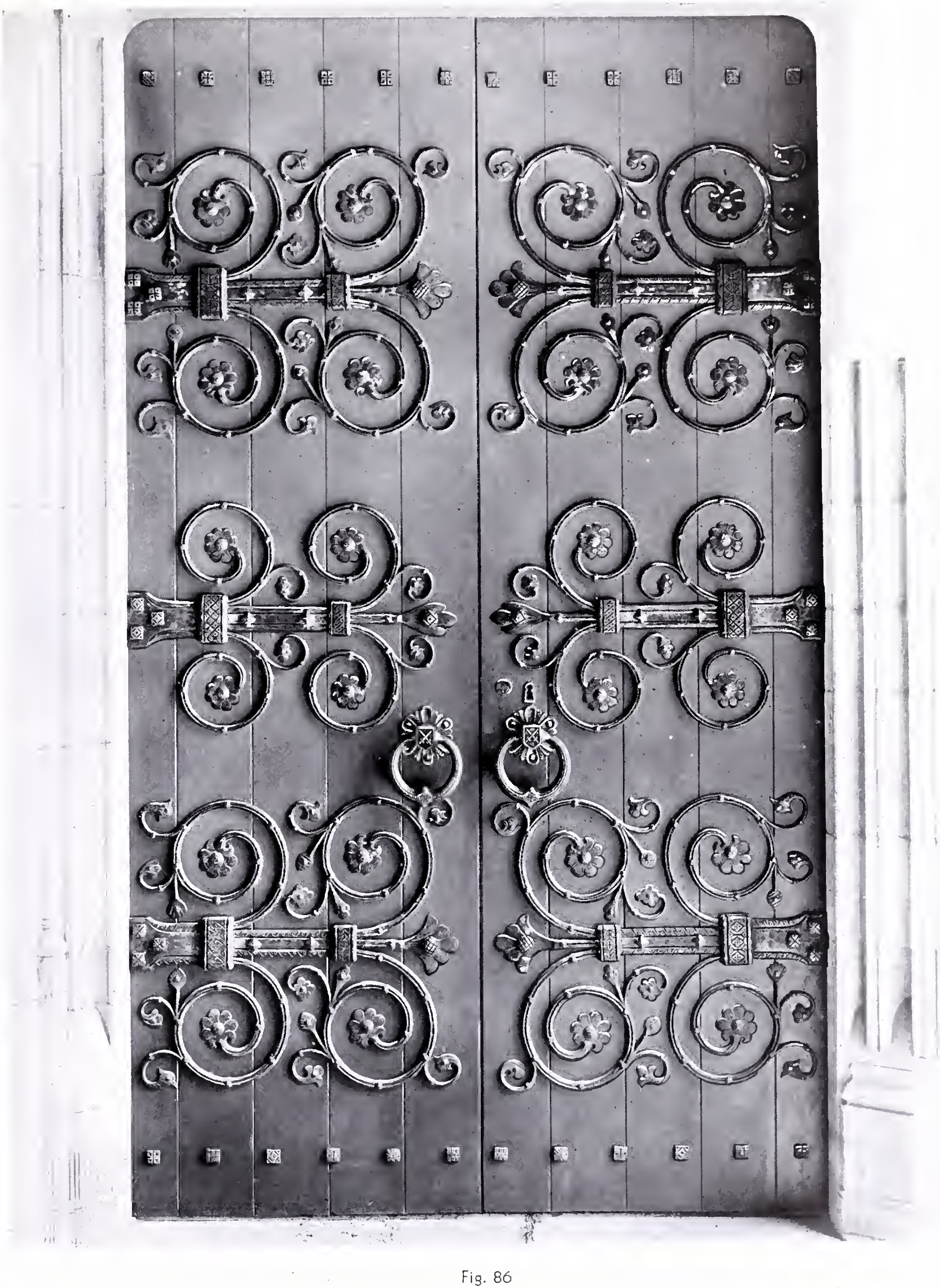


Fig. 86
Hand wrought Monel Metal hardware, main entrance doors, St. Paul's Church, Chestnut Hill, Pa. Designed by Zantzinger, Borie & Medary, Architects, Philadelphia, Pa. Executed by Jacob Schmidt, Philadelphia, Pa.

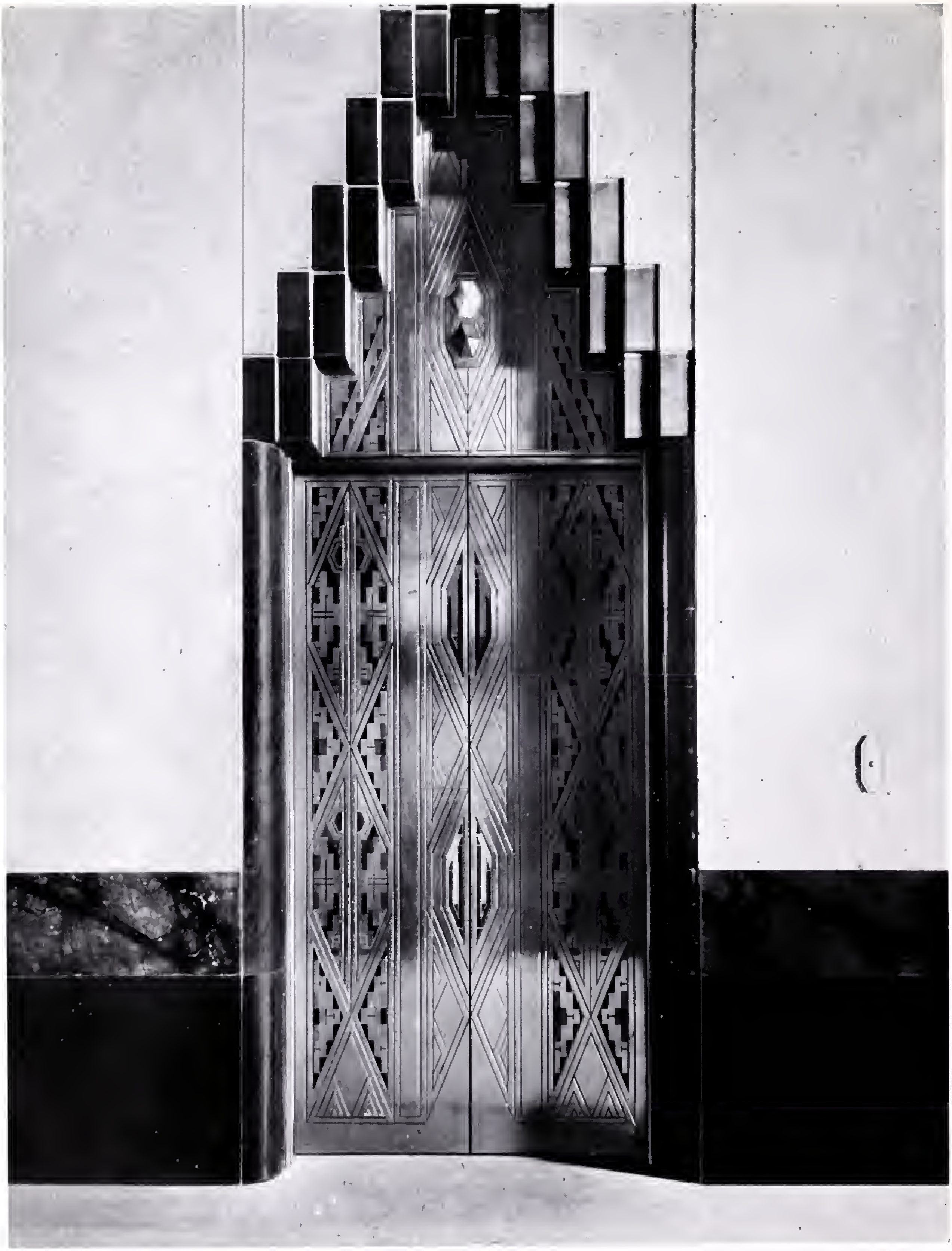


Fig. 87
Monel Metal elevator door with routed ornament inlaid with Tiffany Favrile Glass, Union Trust Company Building, Detroit, Mich. Designed by Smith, Hinchman & Grylls, Architects, Detroit, Mich. Executed by the Dahlstrom Metallic Door Company, Jamestown, N. Y.

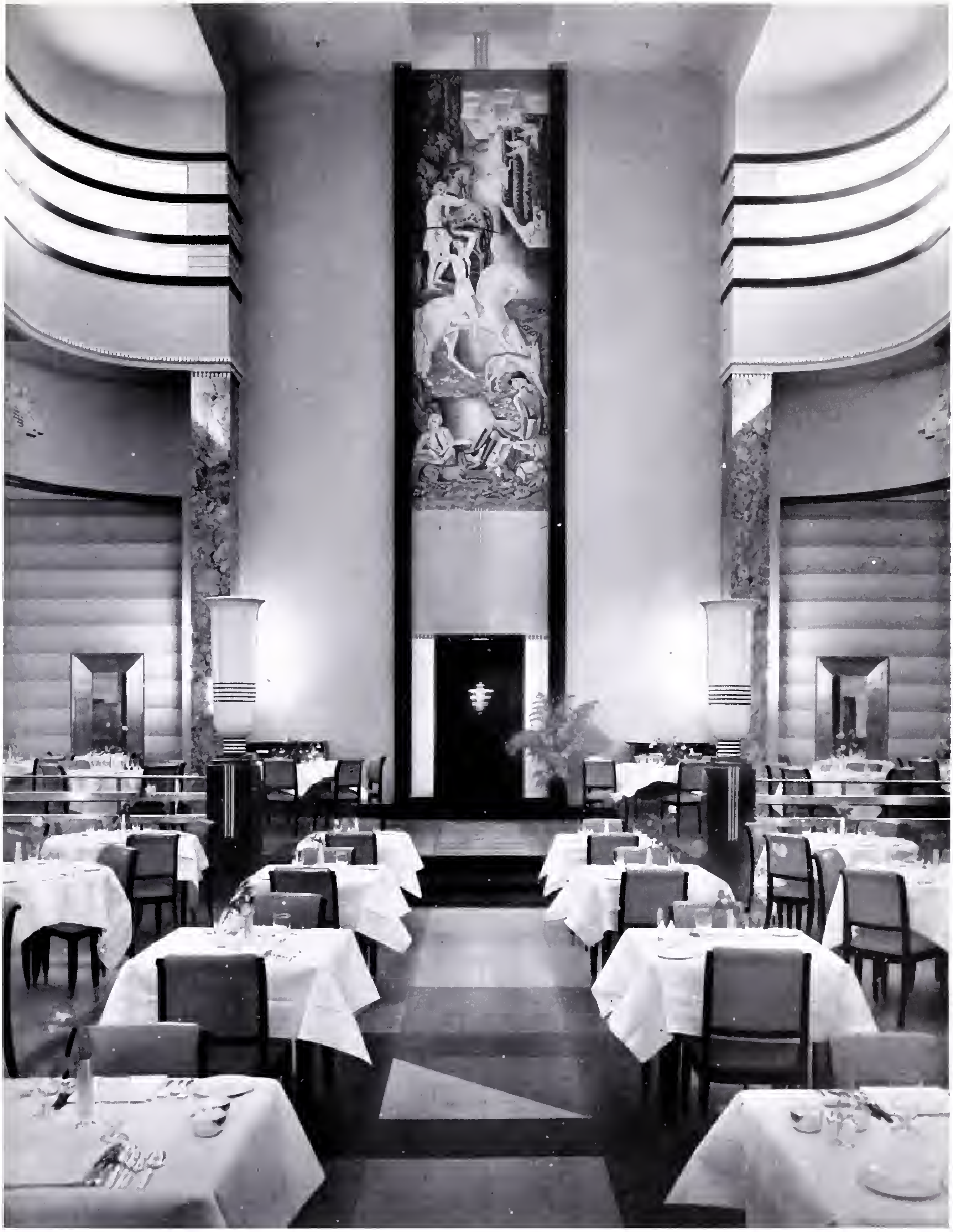


Fig. 88

Restaurant T. Eaton Store, Montreal, Canada. Monel Metal doors, trim, railings and lighting fixtures. Designed by Jacques Carlu for Ross & MacDonald, Architects, Montreal, Canada. Monel Metal doors, trim, railings executed by The Robert Mitchell Company, Ltd., Montreal, Canada. Lighting fixtures executed by The Electrolier Mfg. Co., Montreal, Canada.

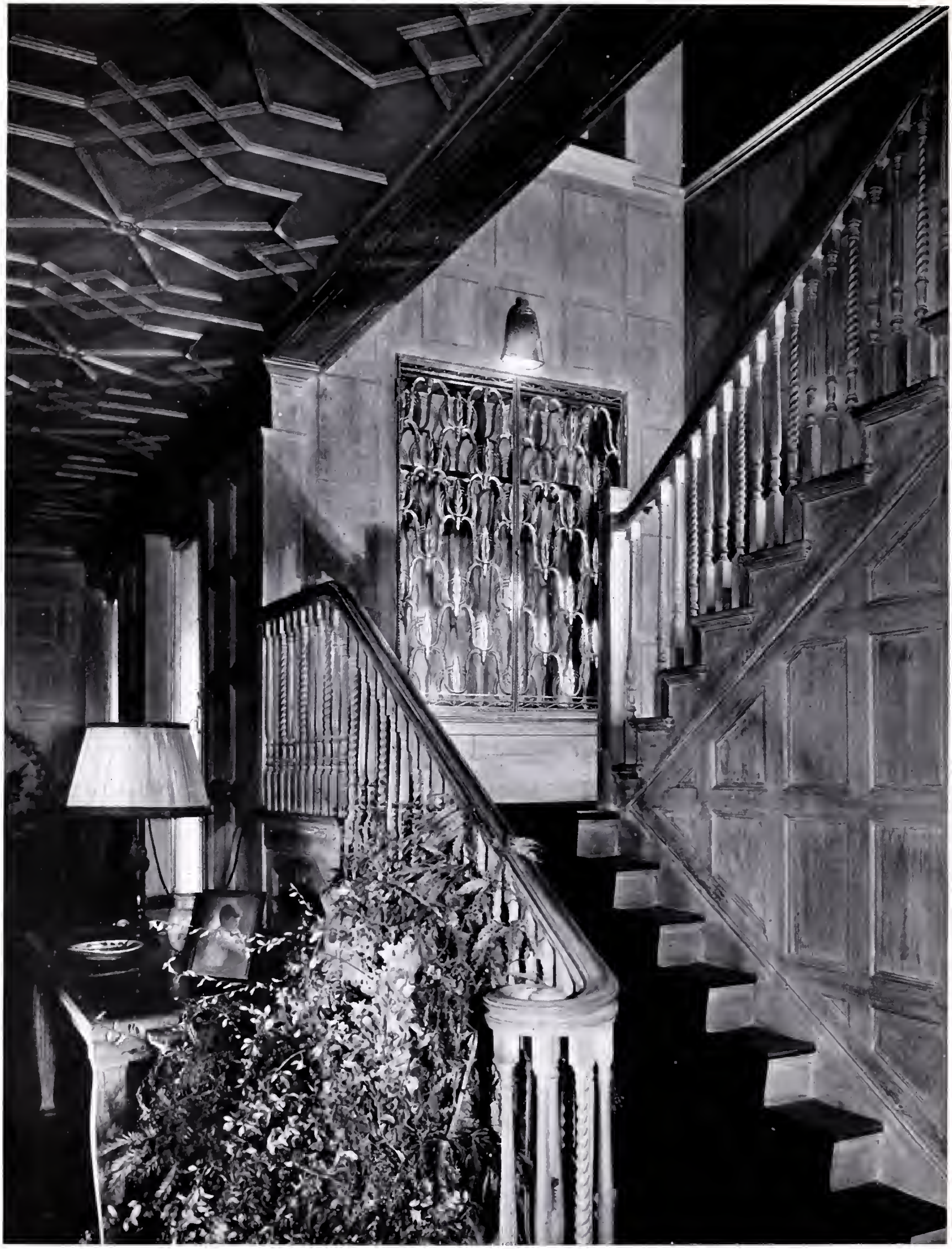


Fig. 89

Monel Metal grille with contrasting parts of brass, apartment of Mrs. Charles J. Liebman, New York. Designed by Ely Jacques Kahn, Architect, New York. Executed by Kantack & Company, Inc., New York.

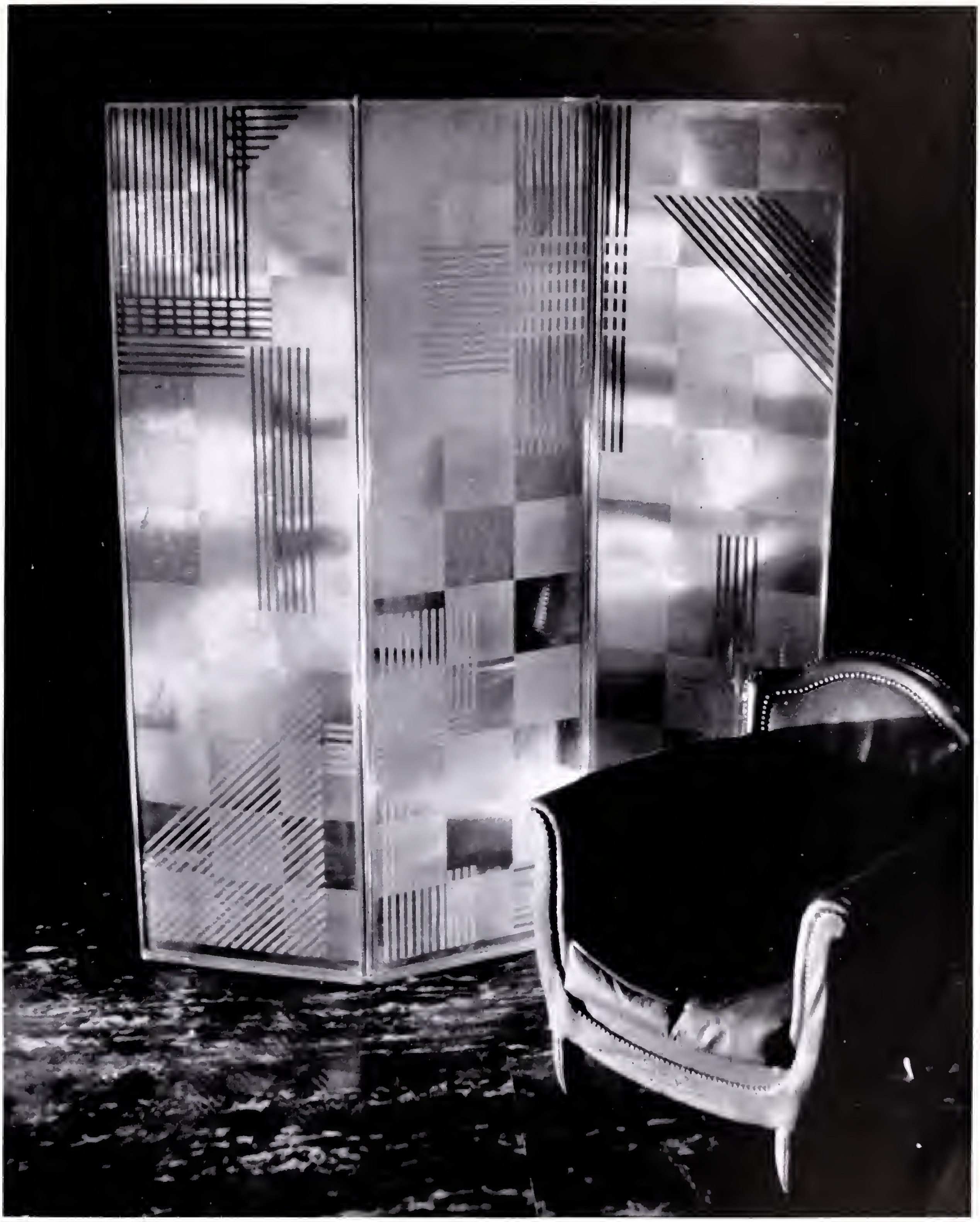


Fig. 90
Monel Metal screen "carved" by sandblasting through stencils. Designed by L'Elan, Inc., New York, N. Y. Carved by Peter Anders, Inc., New York, N. Y. Executed by the Columbian Art Metal Works, Guttenberg, N. J.

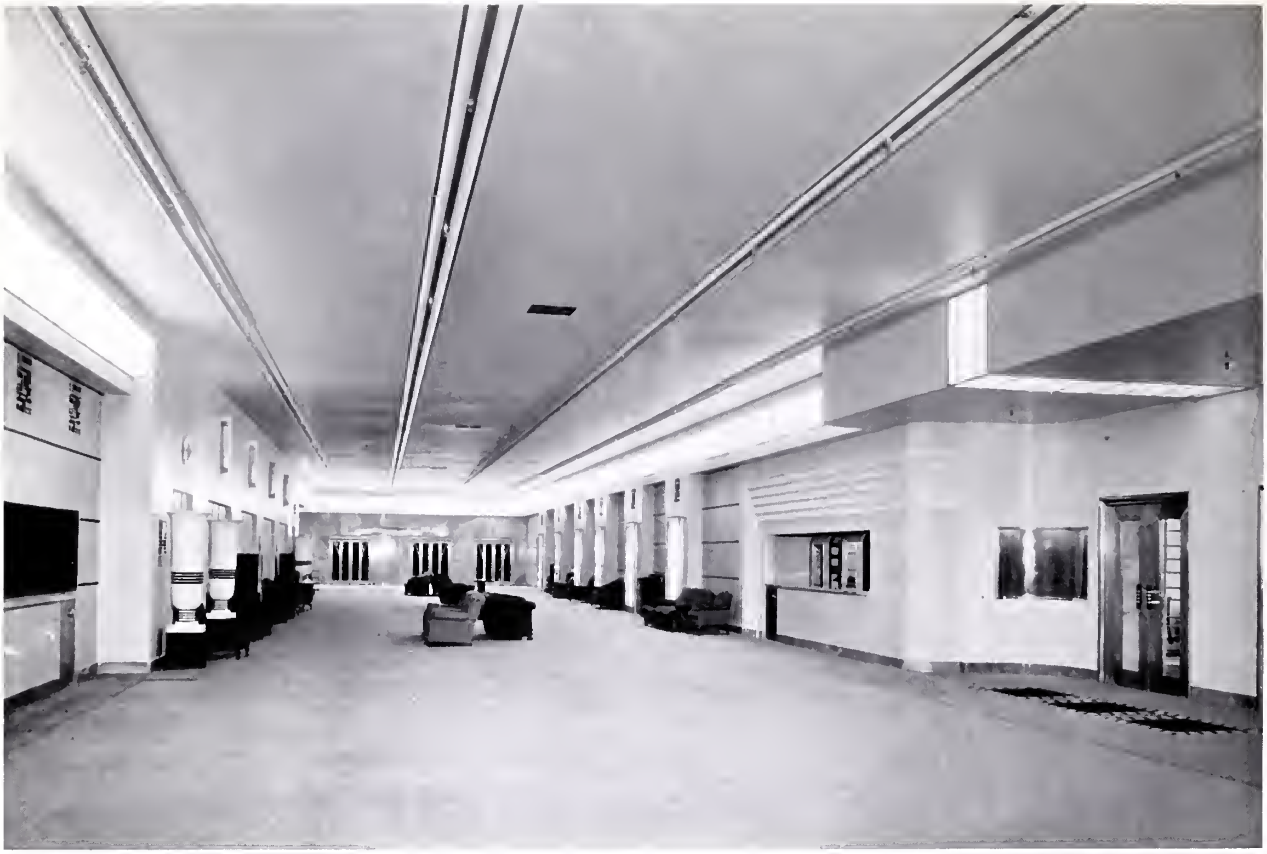


Fig. 91
Corridor to restaurant T. Eaton Store, Toronto, Canada. Monel Metal doors, grilles and lighting fixtures. Ross & MacDonald, Architects, Montreal, Canada. Associate Architects, Sproatt & Rolph, Toronto, Canada. Metal work executed by Architectural Bronze & Iron Works, Toronto, Canada.

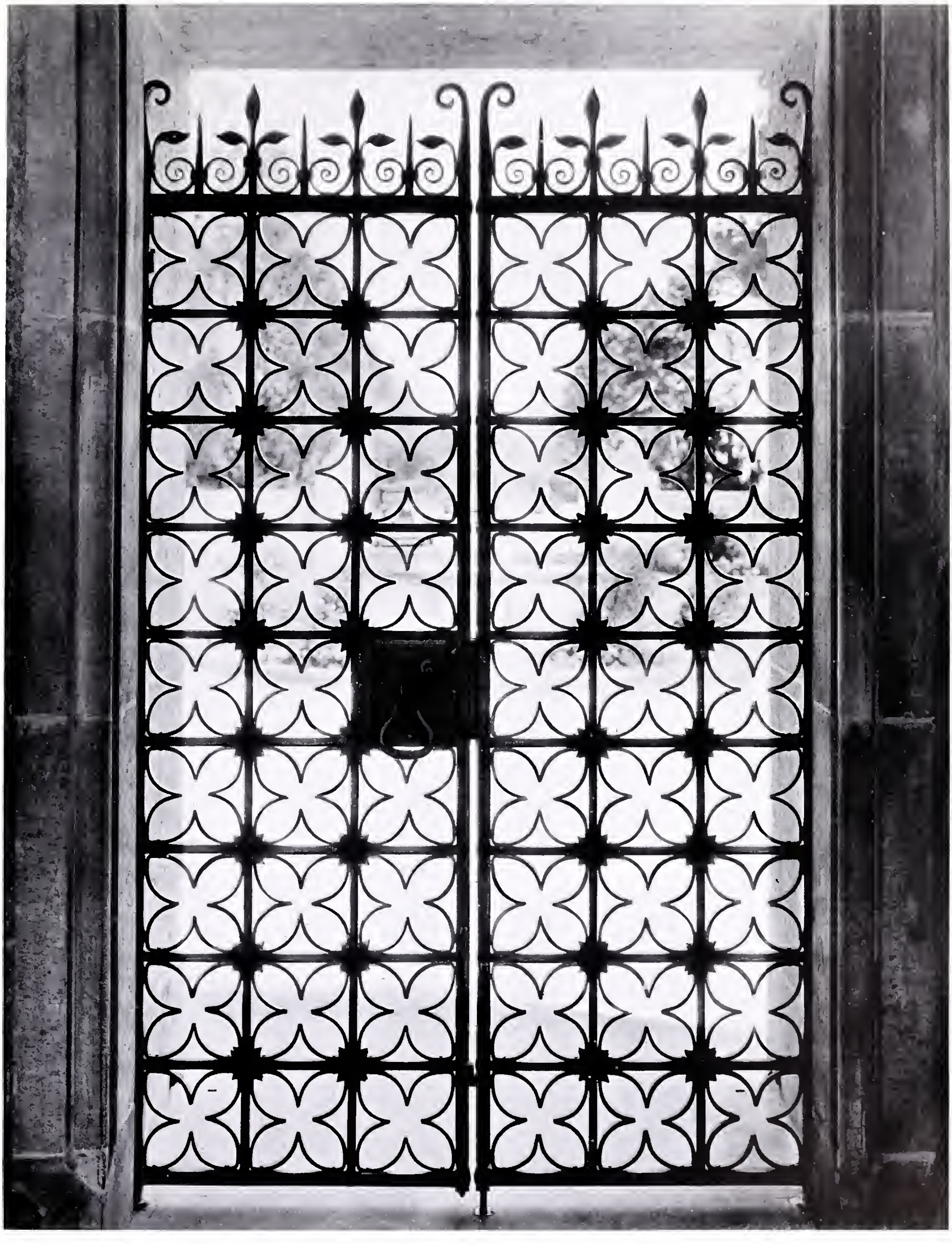


Fig. 92
Hand wrought Monel Metal gates, B. O. Phillips residence, Butler, Pa. Designed by Janssen & Cocken, Architects, Pittsburgh, Pa. Executed by Samuel Yellin, Philadelphia, Pa.

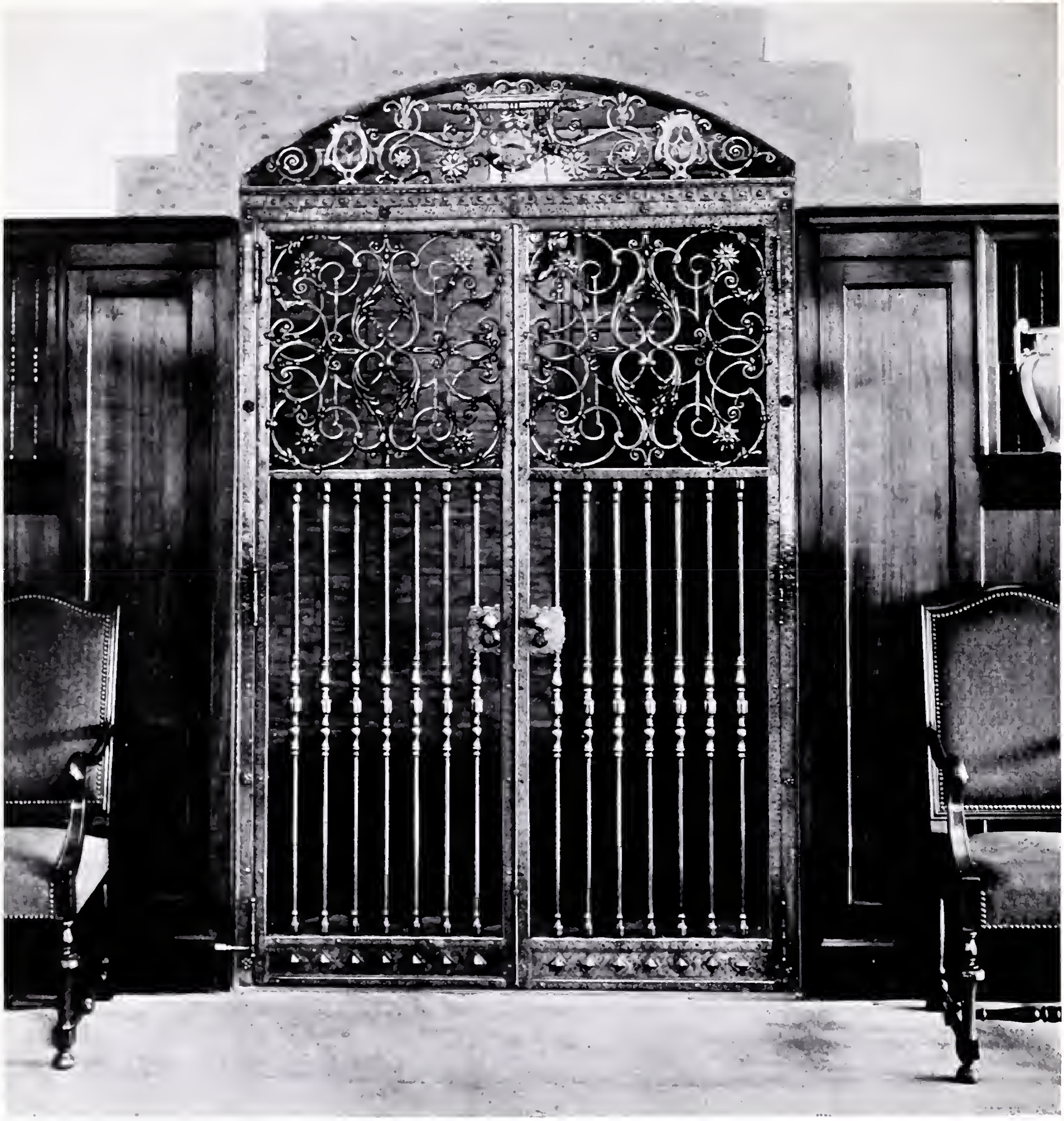


Fig. 93

Hand wrought Monel Metal gates, show rooms of Raymond C. Yard, New York. Executed by the Hand Craft Iron Corporation, New York.

Fig. 94
Monel Metal fireplace, grate, andirons and fire tools, designed by Eugene Schoen, New York. Andirons and fire tools executed by Lansha Studios, New York. Enclosure of Monel Metal and copper executed by Paul Lobel.

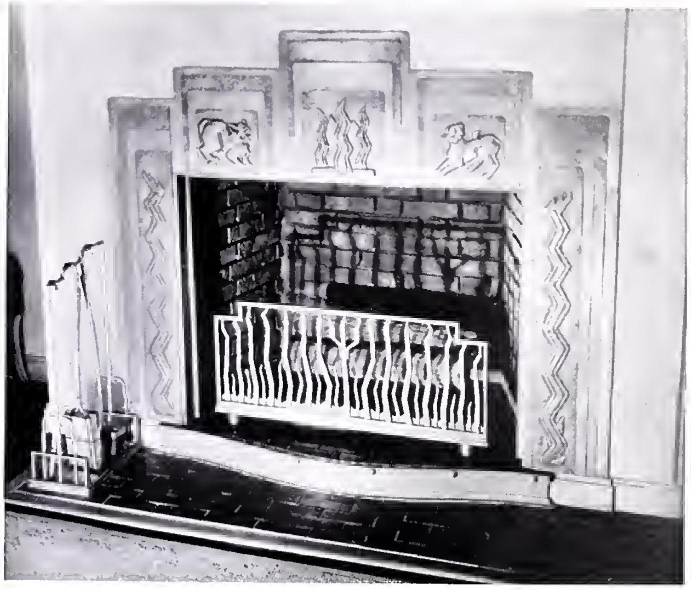
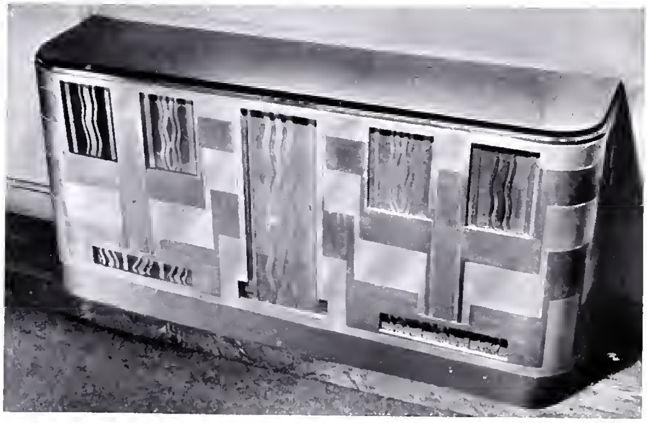


Fig. 95
Monel Metal radiator enclosure, designed by Eugene Schoen, New York. Executed by the William O. Chapman Co., New York.



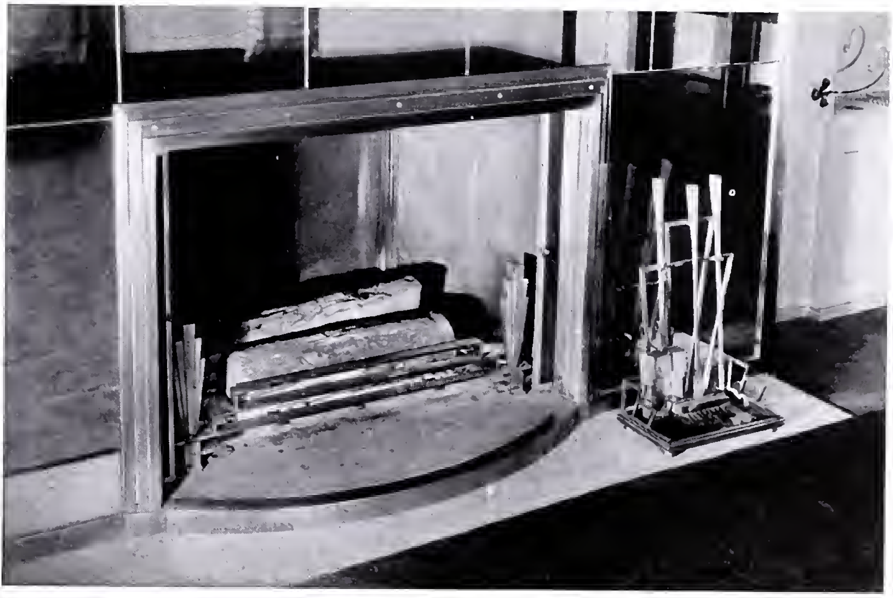


Fig. 96
Monel Metal fireplace, designed by Eugene Schoen, New York and executed by William O. Chapman Co., New York.

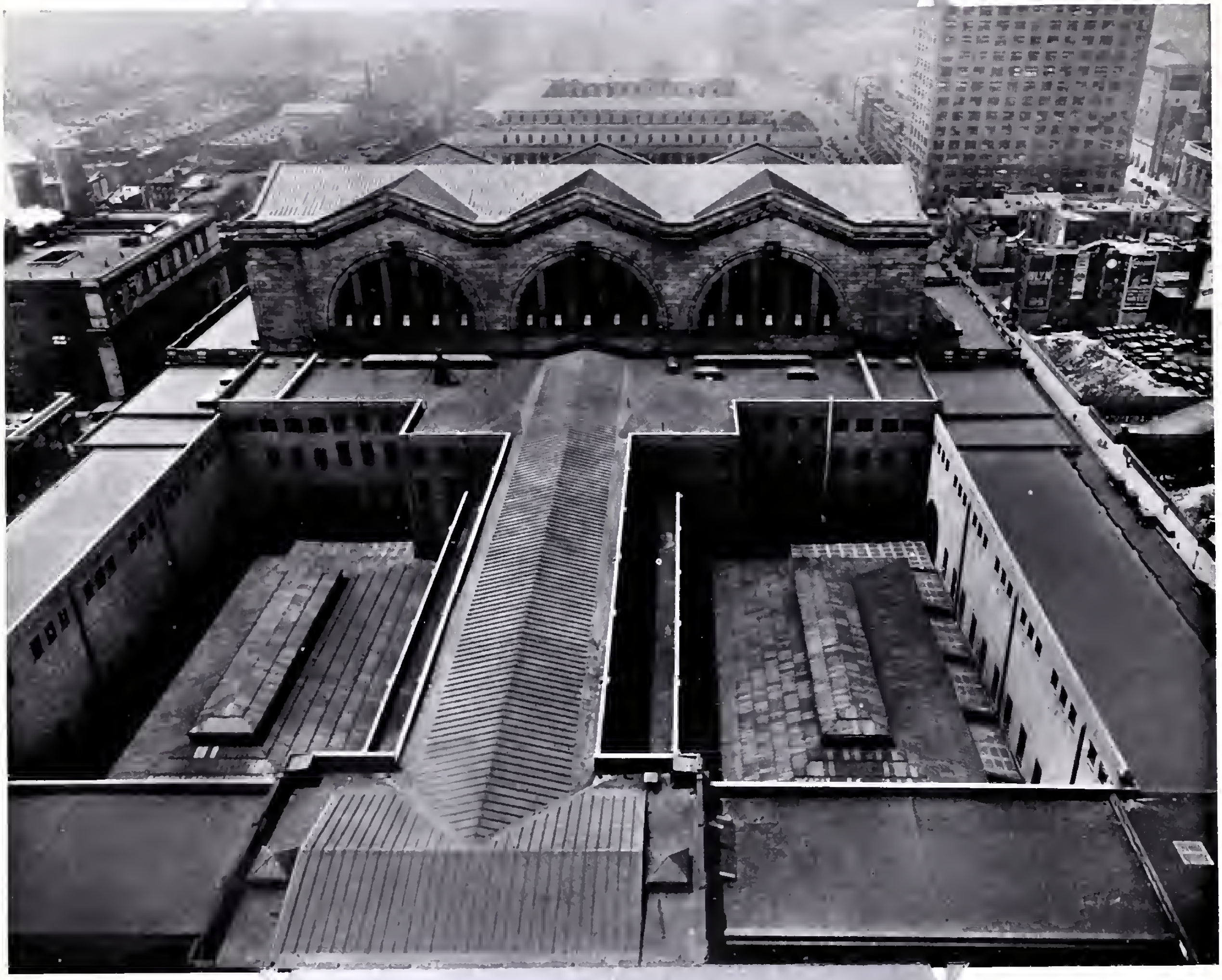


Fig. 97

Since 1909, this Monel Metal roof on the Pennsylvania Railroad Station in New York City has withstood exposure to the elements and noxious fumes with no perceptible deterioration. Scientists say it is good for a minimum of 300 years more.

Utilitarian Uses of MONEL METAL in Building Construction and Equipment

THE physical, mechanical and chemical properties of Monel Metal create a number of uses for it in building construction and equipment other than uses which may be termed ornamental or decorative. In its utilitarian service, the color and finish of Monel Metal is secondary to its resistance to corrosion, its strength, toughness, rigidity and related properties.

Roofing

The Pennsylvania Railroad Station in New York City was covered with a roofing of Monel Metal in 1909. This metal was chosen because the designers sought absolute permanency in atmospheric conditions that favored the corrosion of less resistive materials. After more than twenty years of service, sections of the Monel Metal roof were removed and subjected to critical examination by expert metallurgists. There was no appreciable loss in weight of the metal,—the very slight diminution in thickness being attributable as much to variation in thickness of the original metal as to any form of corrosion. The metallurgists making the examination indicated that if the extremely slight change in thickness continued uniformly at the rate observed, the roof would have a useful life of at least three hundred years more and possibly for many centuries longer.

Monel Metal makes an excellent roofing material for all permanent structures and particularly for those exposed to atmosphere carrying sulphur or other corrosive fumes. Several advantages should be noted. First, the metal can be brazed, welded or soldered in place, making it possible to permanently establish an absolutely watertight condition. Second, the metal can be seamed if desired, using the double-lock seam customarily employed with copper or other softer roofing metals. Third, the metal is stronger than mild steel, which makes it an admirable material for the insulated deck type of roofing and permits the use of wider spans, thus allowing a reduction in the number of structural supports. Fourth, the extreme durability of Monel Metal permits the use of lighter gauge sheets than would be appropriate with less permanent materials so that the relative weight and cost of a Monel Metal roof makes it compare favorably with cheaper metals.

Expansion Joints

The Merchandise Mart in Chicago and the Cleveland Union Terminal Building, and other similar structures erected over railroad tracks are equipped with Monel Metal expansion joints at the point where these structures are isolated from the surrounding source of vibration. Several miles of Monel Metal strip were used in the Merchandise Mart alone. The advantages possessed by Monel Metal for this purpose are quite obvious. Similarly Monel Metal is unexcelled for expansion joints designed to allow for temperature expansion and contraction. Such joints are essential in many structures

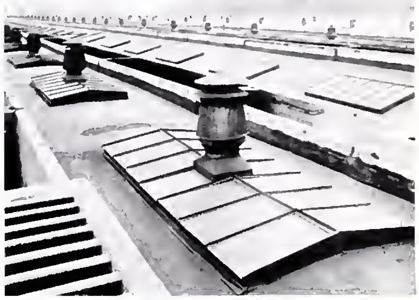


Fig. 98
Monel Metal sky lights, ventilators and smoke hoods installed at the Chicago Northwestern Station, Chicago, Ill.

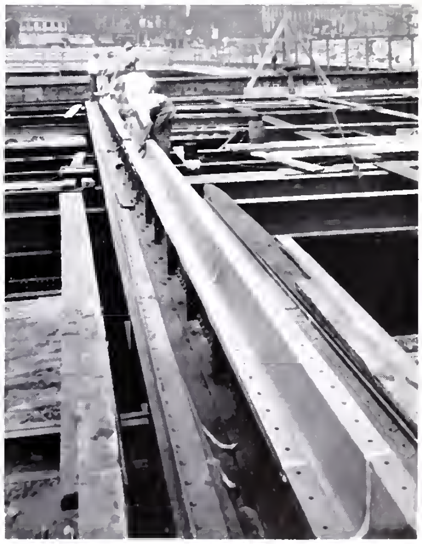


Fig. 99
Monel Metal expansion joint being placed in Cleveland Union Terminal, Cleveland, Ohio. Over three miles of Monel Metal expansion joints were used on this job. Riester & Thesmacher, sheet metal contractor.

such as bridges and elevated highways, large buildings of reinforced concrete or steel construction and at the joining of two related but independent buildings.

These expansion joints are usually inaccessible and often invisible after the structure is completed and yet upon their efficiency depends the weather-tightness of the contact between the structure and the surrounding materials or between adjacent units subject to independent movement. Its freedom from corrosion, its resistance to fatigue, its strength and its extreme durability give Monel Metal an insuperable advantage over other materials for such uses.

Machine Parts

Elevator machinery, fire pumps, service pumps, electric motors, steam turbines and many other types of machines employed in building service contain Monel Metal parts where the wear is greatest or where freedom from corrosion is an essential property.

Food Service Equipment

Monel Metal is extensively used in food service equipment because it neither contaminates food of any type, nor is subject to attack or corrosion by foods or cooking processes. Monel Metal food service equipment has proved eminently satisfactory in more than twenty years of use. Many manufacturers of food service equipment for hotels, hospitals, restaurants and homes employ Monel Metal extensively or sometimes exclusively in the production of their standard units. Several typical items of domestic and commercial food service and laundry equipment are illustrated on pages 65, 66 and 67. Special publications are offered to architects covering food service equipment.

Laundry Equipment of Monel Metal

Similarly, Monel Metal is universally used in laundry machinery because of its freedom from corrosion, its strength and its inability to discolor textiles.

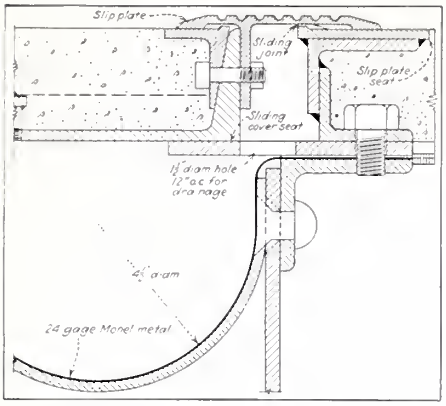


Fig. 100
Part-section through street pavement expansion joints (transverse and longitudinal) showing U-shaped Monel Metal gutter on the Cleveland Union Terminal Building.

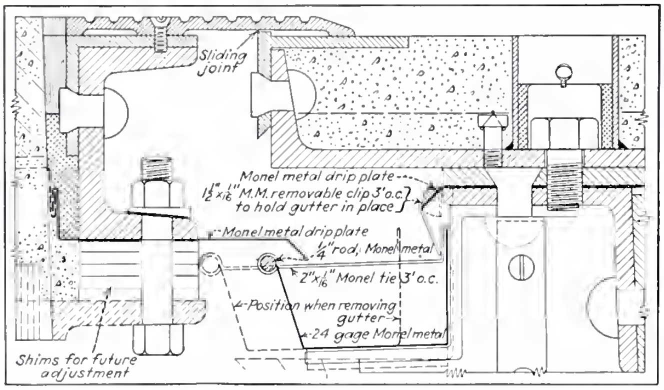

Sliding joint
Monel metal drip plate
1½"x1/16" M.M. removable clip 3' o.c. to hold gutter in place
Monel metal drip plate
¼" rod, Monel metal
2"x1/16" Monel tie 3' o.c.
Position when removing gutter
24 gage Monel metal
Shims for future adjustment

Fig. 101
Cross section of expansion joints between sidewalks and buildings showing square Monel Metal gutter.

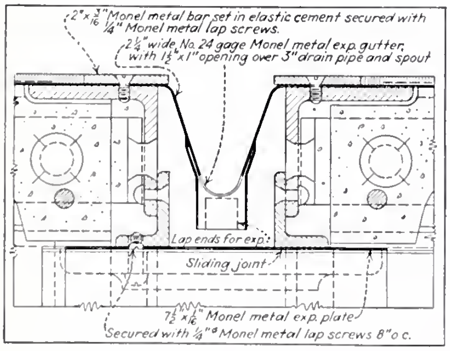

2"x3/16" Monel metal bar set in elastic cement secured with ¼" Monel metal lap screws.
2¼" wide No. 24 gage Monel metal exp. gutter, with 1½"x1" opening over 3" drain pipe and spout
Lap ends for exp.
Sliding joint
7½"x1/16" Monel metal exp. plate
Secured with ¼"⌀ Monel metal lap screws 8" o.c.

Fig. 102
Shows Monel Metal member of expansion joints in suspended ceilings directly below joints as shown in Figs. 100 and 101.

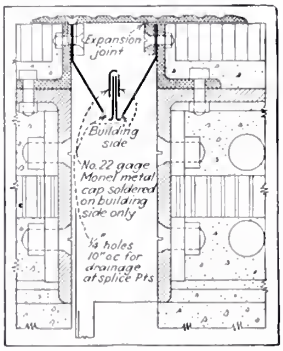

Expansion joint
Building side
No. 22 gage Monel metal cap soldered on building side only
¼" holes 10" oc for drainage at splice Pts

Fig. 103
Shows Monel Metal seals for expansion joints at floor levels directly under those shown in Figs. 100 and 101.

Note: A point of probable interest in connection with this Cleveland Union Terminal job, is found in the fact that notes on the blueprints of architect's drawings specified a calculated rate of allowance for expansion or contraction, for erection at temperatures varying from a base of 40 deg. Fahr.

Domestic, institutional and commercial laundry equipment, including laundry chutes, are commercially available in Monel Metal.

Domestic Uses

Monel Metal sinks, trays, drainboards, table and counter tops, refrigerator linings, ovens and trim on stoves, ventilating hoods, ice boxes, dishwashers and washing machines are available in a wide variety of standard forms or can be built up to order and add much to the home or apartment kitchen and laundry.

Particular attention is called to the standardized Monel Metal kitchen sinks manufactured by The International Nickel Company and illustrated on pages 68 and 69. These sinks of the highest quality construction are available in three standard types and in a range of sizes to meet all normal requirements. Complete information concerning them will be supplied on application.

For maximum efficiency in the domestic establishment, architects may plan their kitchens, pantries and laundries to meet precisely space and individual service requirements. Under such circumstances, custom-built equipment of Monel Metal can be procured at surprisingly reasonable cost. A special publication on this subject, giving detailed specification data, will be supplied on request.

Other Uses

Monel Metal is used for tanks and for certain types of pipe wherever either freedom from contamination of the water or freedom from corrosion and deterioration are essential. Many hundreds of uses of Monel Metal have been developed in the manufacturing and chemical industries in the handling and preparation of foods. Many of these uses are adaptable to special building problems. Complete data on any possible service use of Monel Metal will be supplied on request by The International Nickel Company.

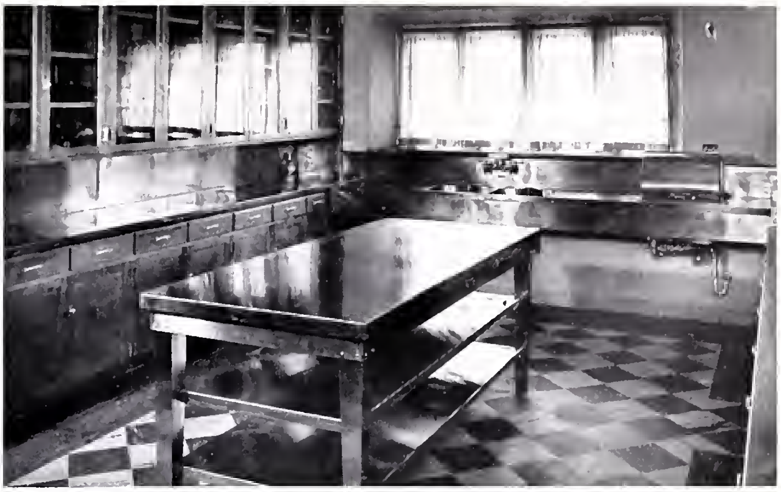


Fig. 104
Complete Monel Metal installation, cabinet tops, sink, table, etc. in the Phillips residence in Butler, Pa. manufactured and installed by Demmler & Schenck of Pittsburgh. Janssen & Cocken, architects Pittsburgh, Pa.

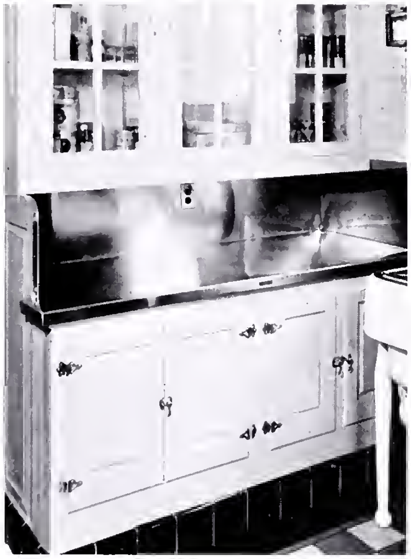


Fig. 105
Monel Metal cabinet top in the George Driscoll residence, Brooklyn, N. Y. manufactured by Rudman & Scofield.

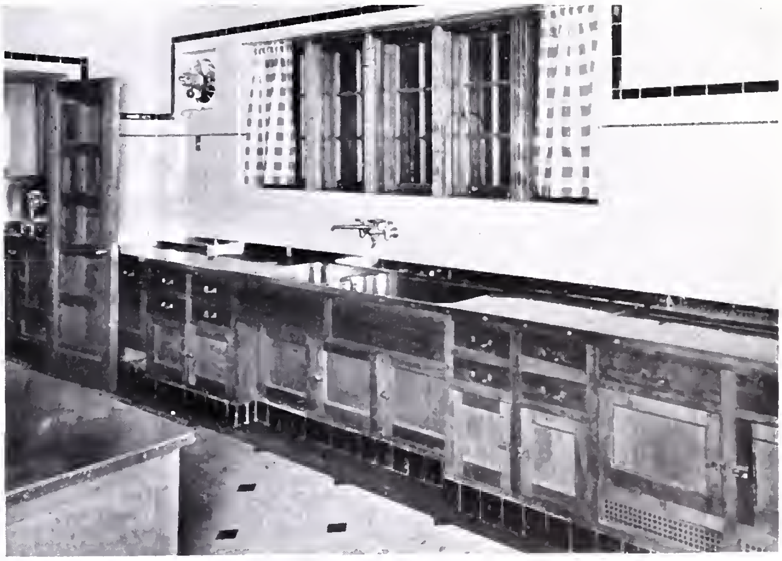


Fig. 106
Monel Metal custom built sink and counter top in the residence of Mr. Ralph H. Soby, West Hartford, Conn. manufactured by the Hooker Mfg. Co. of Hartford, Conn.

DOMESTIC AND FOOD SERVICE AND

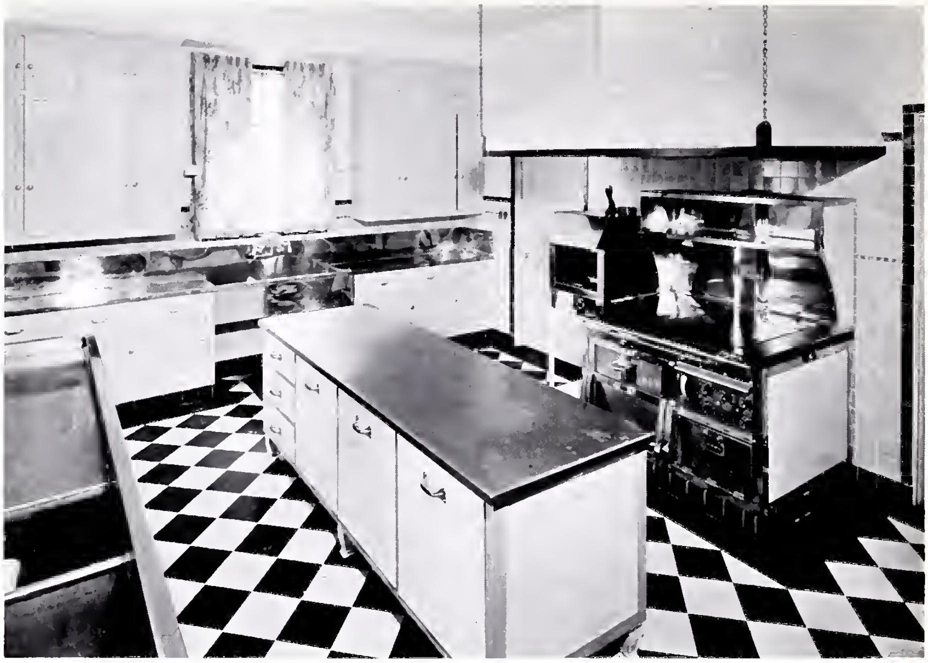


Fig. 107
Monel Metal sinks, table top range, and broiler in the residence of Mr. J. M. West, Houston, Texas. Monel Metal equipment manufactured by the Texas Hotel Supply Company.

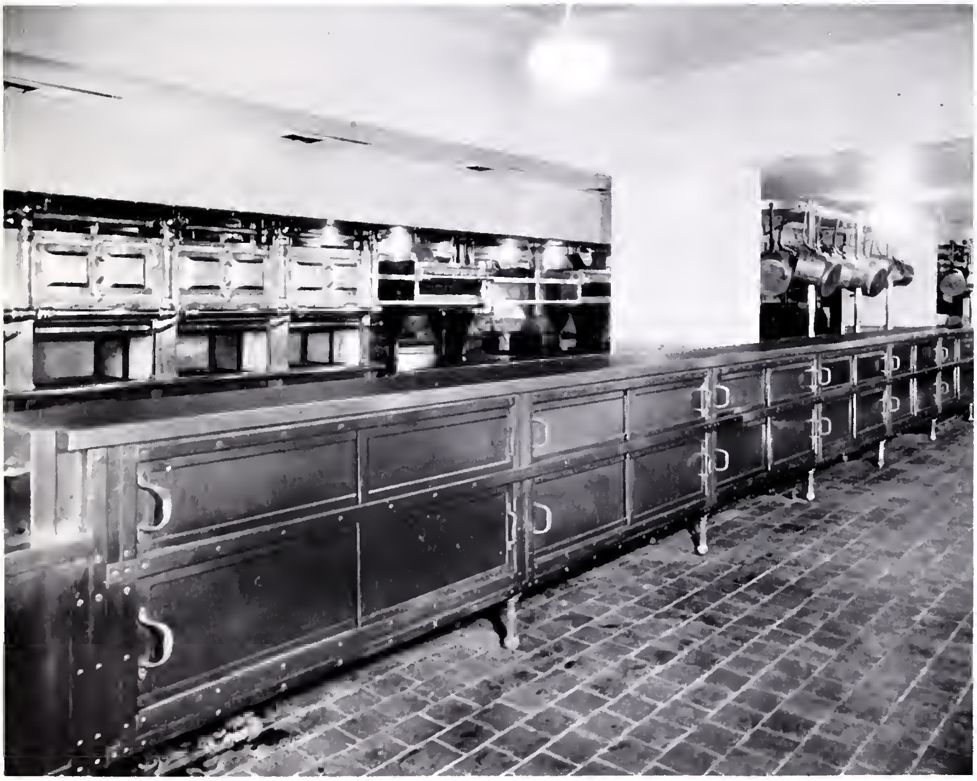


Fig. 108
Main kitchen of the Stevens Hotel, Chicago, Ill. showing Monel Metal dishwarmers, ranges, etc. Monel Metal equipment manufactured and installed by Albert Pick Barth & Co., Chicago, Ill.

COMMERCIAL LAUNDRY EQUIPMENT

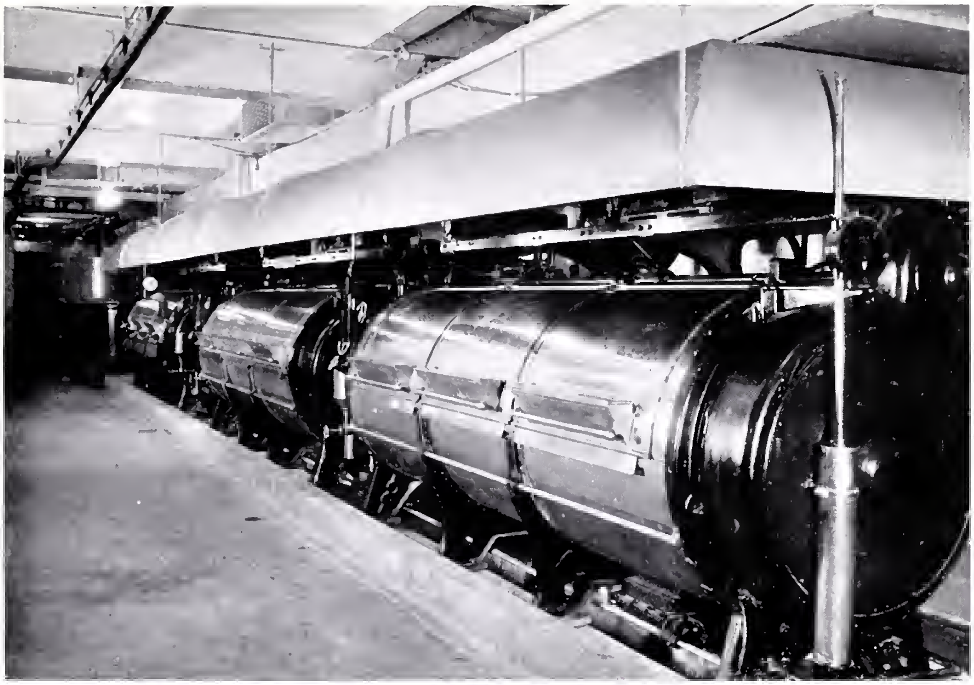


Fig. 109
Part of the battery of Mammoth Cascade Monel Metal washers and extractors in the laundry of the New Yorker Hotel, New York City, manufactured and installed by the American Laundry Machinery Company, Cincinnati, O.

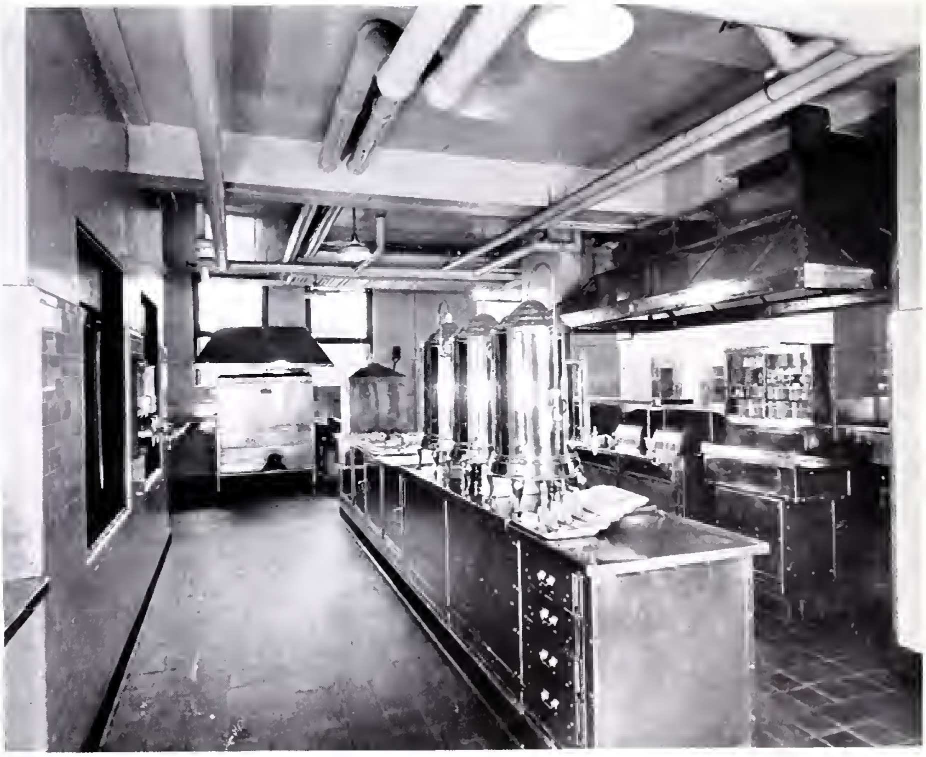


Fig. 110
Monel Metal equipment in the kitchens of the Henry Ford Hospital, Detroit, Michigan, manufactured and installed by the John Van Range Company of Cincinnati, Ohio.

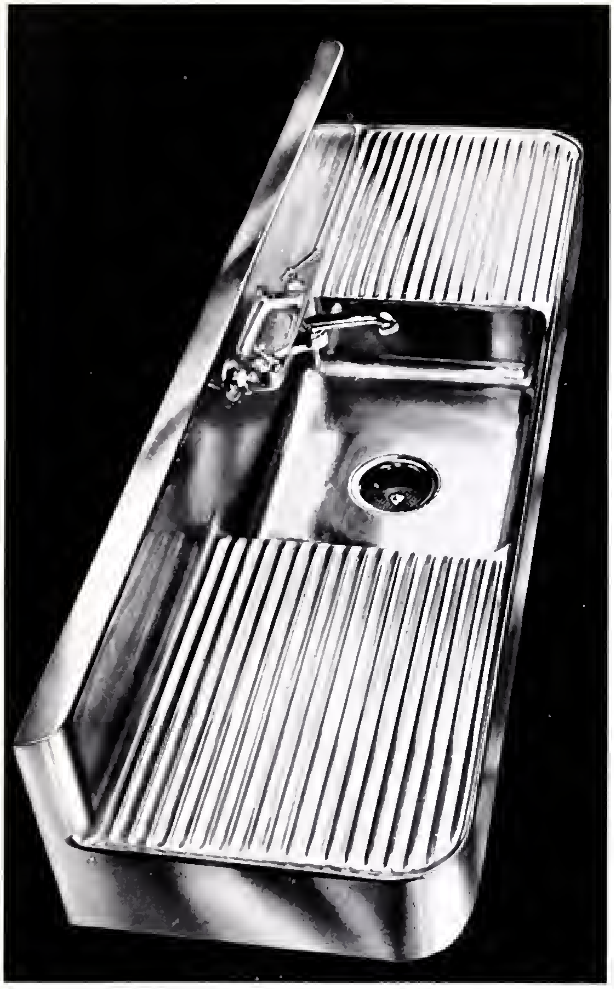


Fig. 111
The handsome lines and attractive silvery appearance of these new Monel Metal sinks bring new beauty into the modern kitchen.

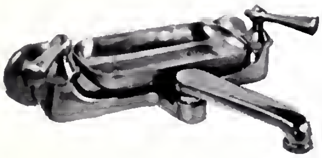
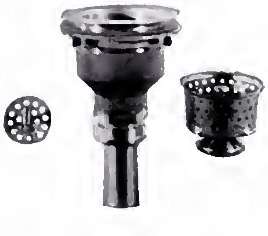


Fig. 112
A solid 20% Nickel Silver faucet is recommended for all Monel Metal sinks. Made of solid metal, with no coating to chip, crack or wear off, it has the lifetime durability that is characteristic of the new Monel Metal sinks.

Fig. 113
All standardized Monel Metal sinks are regularly supplied, without extra charge, with strainer drain made of solid 20% Nickel Silver. These drains have removable crumb-catching strainer and 2-position stopper.



Standardized MONEL

THE same combination of properties that make Monel Metal so desirable for ornamental purposes—beauty, strength, durability, resistance to corrosion and ease of cleaning—also recommend its use in the home. Architects have long employed Monel Metal for custom-built sinks, drainboards, cabinet tops, table tops, and similar kitchen equipment in fine homes. Now the unusual advantages offered by Monel Metal may be had in the new standardized Monel Metal kitchen sinks. Designed by Gustav Jensen, they are brought within the reach of every homeowner by quantity production.

Quality Construction

These sinks are of one piece construction—solid one piece bowl invisibly welded to drainboards, splashback and apron. 16 gauge U.S.S. (.062") Monel Metal is used throughout. The entire sink is reinforced with a welded steel framework sufficiently strong to take care of any strains. The metallic sound ordinarily associated with metal fixtures is eliminated by a ½" layer of sound deadening material fastened to drainboards and splashback and a special sound-deadening compound laid over the entire underbody.

Attractive Finish

The satin finish standard on these new Monel Metal sinks has been especially created to meet the requirements of domestic service. It is reflective but not mirrorlike, lustrous but not too shiny—neither too bright nor too dull. No matter what decorative treatment is used these attractive Monel Metal sinks always harmonize perfectly with their surroundings.

Where To Buy Them

Inco standardized sinks are sold by plumbing supply jobbers and contractors throughout the United States and Canada. The plumber who handles your work will give you full information, roughing in dimensions, etc. or this data may be obtained by writing to The International Nickel Company.

METAL Kitchen Sinks

10 Different Models

There are ten models available in six different sizes:

Model INCO S 720	21″ x 72″	Double Drainboard
Model INCO S 600	21″ x 60″	Double Drainboard
Model INCO S 495L	21″ x 50″	Single Left Hand Drainboard
Model INCO S 495R	21″ x 50″	Single Right Hand Drainboard
Model INCO S 5075L	21″ x 51″	Single Left Hand Drainboard With bowl end splasher
Model INCO S 5075R	21″ x 51″	Single Right Hand Drainboard With bowl end splasher
Model INCO S 410L	21″ x 41″	Single Left Hand Drainboard
Model INCO S 410R	21″ x 41″	Single Right Hand Drainboard
Model INCO S 4225L	21″ x 42″	Single Left Hand Drainboard With bowl end splasher
Model INCO S 4225R	21″ x 42″	Single Right Hand Drainboard With bowl end splasher

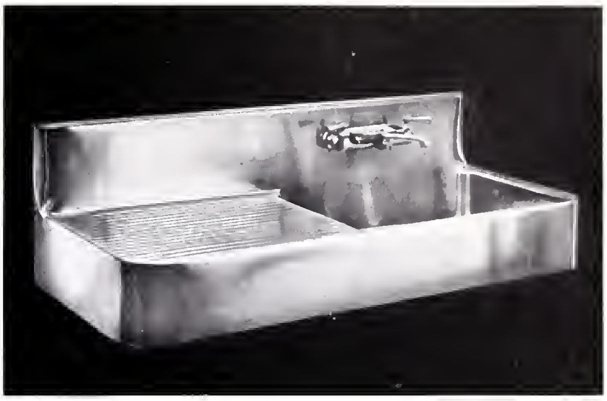


Fig. 114
Single drainboard sinks may be had with drainboard on either right or left side of bowl. They meet the requirements of limited space while providing full working efficiency.

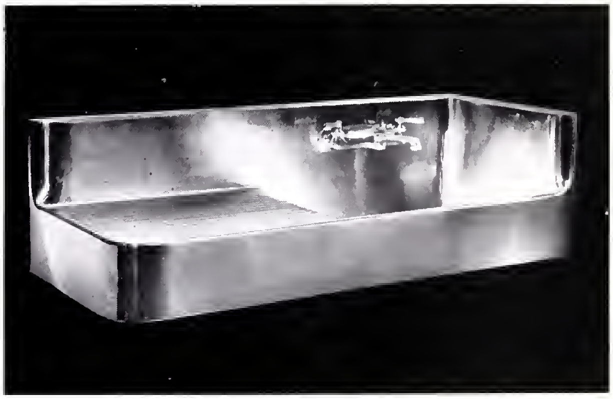


Fig. 115
The addition of the splasher at the bowl corner is an obvious advantage where the sink is to fit into a corner. This model is also available with the drainboard at either the right or the left.

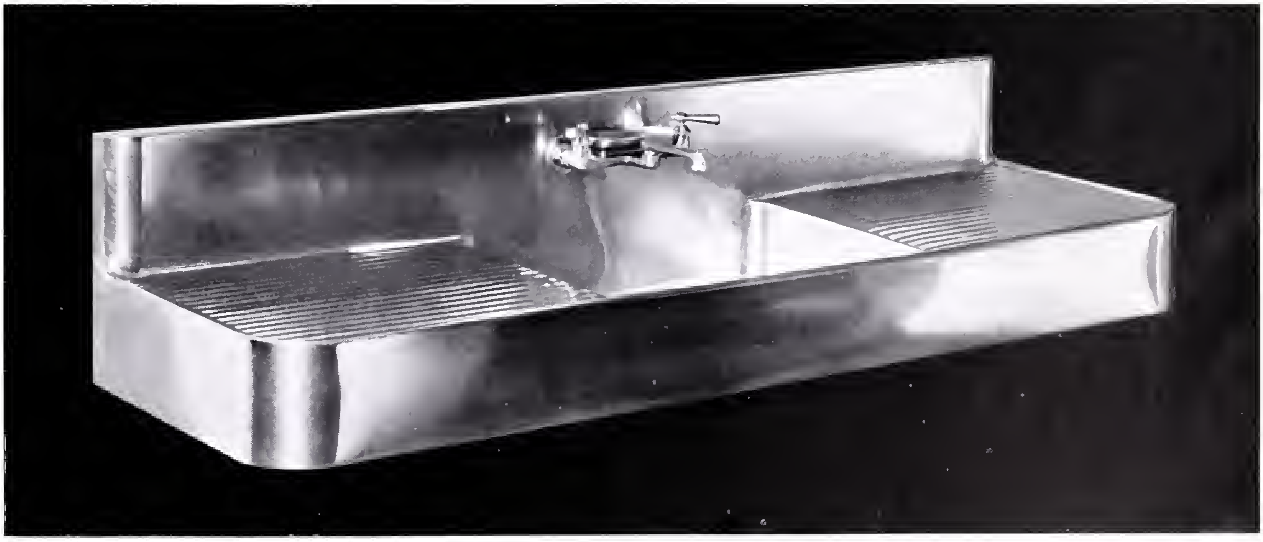
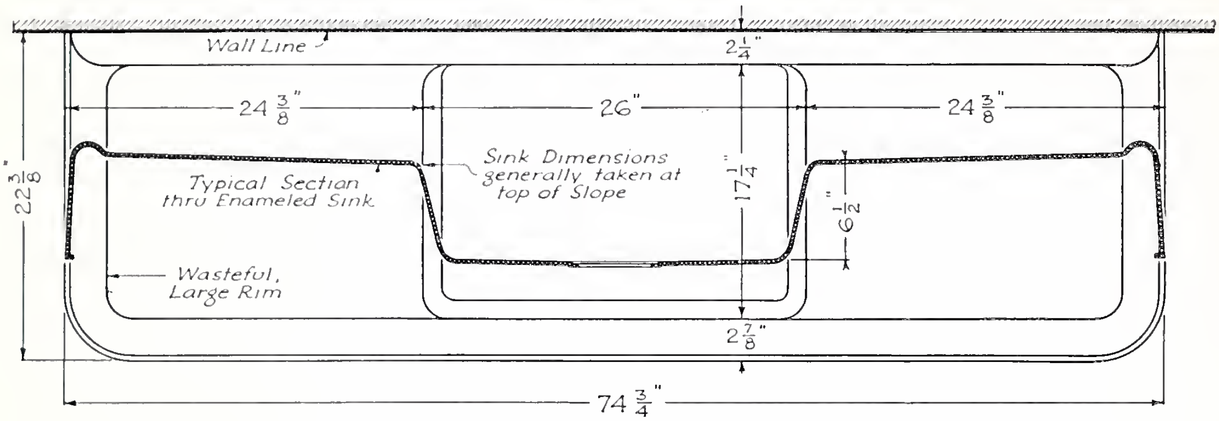


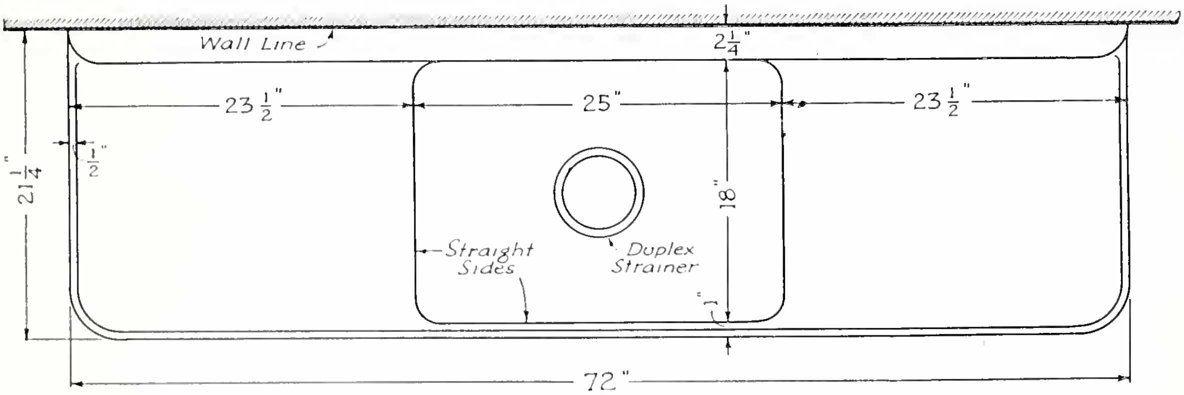
Fig. 116

Comparison of Working Areas
Enameled Sink . . . INCO Monel Metal Sink

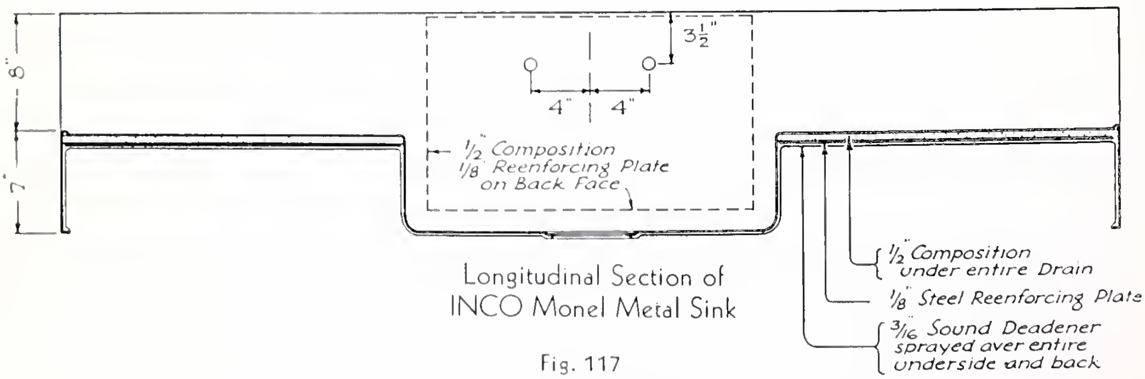

Wall Line
2¼"
24⅜"
26"
24⅜"
22⅜"
Sink Dimensions generally taken at top of Slope
17¼"
6½"
Typical Section thru Enameled Sink
Wasteful, Large Rim
2⅞"
74¾"

Comparative Plan of Enameled Sink

Note the 2⅞" rim on this enameled sink compared to the ½" rim on the Monel Metal sink shown below. Also note the wide curved slope between the drainboards and the sink bowl on the enameled sink . . . there is a similar slope between the splash back and the drainboards. The Monel Metal sink does not have these curved slopes. Monel Metal sinks have an average of 31% increased working drainboard area.



Plan of INCO Monel Metal Sink


8"
7"
3½"
4"
4"
½" Composition
⅛" Reenforcing Plate on Back Face
½" Composition under entire Drain
⅛" Steel Reenforcing Plate
3/16" Sound Deadener sprayed over entire underside and back

Longitudinal Section of
INCO Monel Metal Sink

Fig. 117

INCO AGENTS

INCO agents having men familiar with the ornamental and structural applications of Monel Metal are located in the following cities in the United States and Canada. Their services are available to architects at all times upon request.

ATLANTA
J. M. Tull Rubber & Supply Co.
285 Marietta Street

BOSTON
Whitehead Metal Products Co. of New York, Inc.
67 Washington Street, North

BUFFALO
Whitehead Metal Products Co. of New York, Inc.
319 Niagara Street

CHICAGO
Steel Sales Corporation
129 South Jefferson Street

CINCINNATI
Williams and Company, Inc.
2118 Spring Grove Avenue

CLEVELAND
Williams and Company, Inc.
1748-56 East 22nd Street

DENVER
Hendrie & Bolthoff Mfg. & Supply Co.
1621-39 Seventeenth Street

DETROIT
Steel Sales Corporation
3-218 General Motors Bldg.

ERIE
Williams and Company, Inc.
1121 Erie Trust Bldg.

KANSAS CITY
Steel Sales Corporation
1115 Grand Avenue

LOS ANGELES
Pacific Metals Co., Ltd.
470 East Third Street

MILWAUKEE
Steel Sales Corporation
647 West Virginia Street

MINNEAPOLIS
Steel Sales Corporation
535 South Seventh Street

MONTREAL
Robert W. Bartram, Ltd.
277 Duke Street

NEWARK
Whitehead Metal Products Co. of New York, Inc.
215 Frelinghuysen Avenue

NEW ORLEANS
Equitable Equipment Co., Inc.
410 Camp Street

NEW YORK
Whitehead Metal Products Co of New York, Inc.
304 Houston Street

PHILADELPHIA
Whitehead Metal Products Co. of New York, Inc.
725 Arch Street

PITTSBURGH
Williams and Company, Inc.
901 Pennsylvania Avenue

ST. LOUIS
Steel Sales Corporation
4903 Delmar Boulevard

SAN FRANCISCO
Pacific Metals Co., Ltd.
3100 Nineteenth Street

SEATTLE
Eagle Brass Foundry Co.
21 Spokane Street

TOLEDO
Williams and Company, Inc.
734 Nicholas Bldg.

TORONTO
Peckover's Limited
77 Front Street, E.

VANCOUVER, B. C.
Wilkinson Company, Ltd.
190 West Second Avenue

Monel Metal is a registered trade mark applied to a technically controlled nickel-copper alloy of high nickel content. Monel Metal is mined, smelted, refined rolled and marketed solely by International Nickel.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street
New York, N. Y.

Printed in U. S. A.